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An experimental investigation of the effect of using the arts as media to create an aesthetic learning opportunity.

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AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF USING THE ARTS
AS MEDIA TO CREATE AN AESTHETIC LEARNING OPPORTUNITY

A dissertation Presented

by

Donald William Morris

Submitted to the Graduate School of the
University of Massachusetts in
partial fulfillment of the requirements for the degree of

DOCTOR OF EDUCATION

May

(month)

1971

(year)

Major Subject Aesthetics

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ACKNOWLEDGEMENTS

Many individuals have either directly or indirectly contributed to the success of this project. Appreciation is expressed to the faculty of the Wheelock Elementary School of Keene, New Hampshire, especially Mrs. Shirley Heise, Miss Christine Lancaster and the principal, Mr. George Bergeron, who helped solve the problems of scheduling and implementing this project.

A special note of gratitude to my advisor, Dr. Daniel Jordan, whose constant encouragement, patience and sincere interest in me and the role of aesthetics in education helped me formulate the theoretical construct on which this study is based.

Without the unlimited moral support and the many sacrifices freely given by my wife Marilyn and our four children, Jaydene, Jerry, James and Janelle, this venture would not have been completed. Their interest, understanding, love and good humor encouraged me to continue a very long and difficult task.

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AS MEDIA TO CREATE AN AESTHETIC LEARNING OPPORTUNITY

A Dissertation

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CHAPTER I

STATEMENT AND DEFINITION OF THE PROBLEM

Introduction

This study is the result of an interest in the current curriculum movement toward the arts and humanities as an important part of the education of the individual. This movement is a reaction by students and educators to the formal educational psychology of behavioristic education.

Dr. H. Lyon, Jr., in his dissertation "Study of the Need for and Approach to Humanistic Education," refers to educators as having "...traditionally emphasized the development of the cognitive capacities of their students. The school or university's prime responsibility has been the fostering of intellectual learning. The nurturance of the affective or humanistic side of the student such as feeling, emotions, love, empathy, awareness and fantasy, either has been neglected or left to the individual, his family or chance. All too often, chance prevails, and the result becomes a half-man who has been educated, at best, to function effectively on only the intellectual plane."¹

The Center for the Study of Aesthetics in Education at the University of Massachusetts recently reviewed the need for research in the arts and humanities program in a proposal to the U.S. Office of Education. The following two statements express their concern.

¹ H.C. Lyon, Jr., Learning to Feel - Feeling to Learn, (Unpublished dissertation Ed.D. University of Massachusetts, 1970), Abstract p. 1

New developments in the arts and humanities reported in the literature reveals that innovation in these fields have consisted primarily of limited curricular changes which are not based on any wide-scale reconceptualization of the role of the arts in education, technological experimentation, and organizational revision.

What is needed is a wide conceptual basis for understanding aesthetic experience - one which pertains to both cognitive and affective growth, is amenable to empirical investigation, and can serve as the basis for a new organization of the arts and humanities in institutions of higher education that will foster the kind of curriculum development and evaluation which will enable artists and art educators to clarify, modify, and eventually substantiate their claims for the arts.²

Educational institutions that are developing humanistic education curricula designed to give mini-course exposure with little regard for the interdisciplinary characteristics of these courses and the value of the arts to this program, are placing a new label on a door without changing the contents of the room.

The integration of cognitive learning with affective learning, one of the aims of humanistic education, does not occur by chance. A more realistic curriculum is one that includes subjects such as English, Social Studies, Philosophy, History, Music, Art, Dance, (movement) and Dramatics and that emphasizes the exploration of the interdisciplinary characteristics of these subjects and their social implications by appealing to the individual's aesthetic sensitivity and artistic judgment. The success of this curriculum, of course, depends

² Curriculum Innovation and Research in the Arts and Humanities, (University of Massachusetts School of Education, Amherst, Massachusetts, 1969) Center for the Study of Aesthetics in Education (Mimeograph)

upon the identification of these interdisciplinary characteristics and a clarification of a student's active participation in aesthetic experiences that are conducive to integrated cognitive and affective learning.

Passive exposure to subject content does not insure comprehension of this content or its relationship to concepts. Franz E. Winkler speaks of students' passive participation in education as an important issue for serious consideration:

Obviously, it is possible to impart a great deal of information to pupils by mnemotechnical methods or through television. But this is not education. A child watching passively may remember much of what he has seen and heard but unless he is made to struggle with the subject, the information received will remain a foreign body in his mind. For any kind of knowledge is useful only to the extent to which it enhances inner activity. If merely imposed on the mind, it becomes a heavy weight, paralyzing the forces of will.³

The arts have an important non-verbal aesthetic quality which deals with the individual's visual, audio and kinetic senses, with each art form presenting its own unique sensory involvement. Furthermore, the arts and other disciplines in the curriculum offer to the individual very similar, if not the same, intellectual challenges such as perceiving, reacting, evaluating and conceptualizing. These four behaviors were considered aesthetic by D. Bennet Reimer, a noted psychologist and aesthethician, in a lecture at the Music Educators National Conference convention in Chicago, Illinois, 1970, because they are indigenous to the sensuous knowledge of the individual.

³ Franz Winkler, Man: The Bridge Between Two Worlds, (New York: Harper and Row Publishers, Inc., 1960), p. 212-215

This study is an attempt to identify, construct, and evaluate an environment in which the arts are used to create aesthetic experiences designed to offer the opportunity for the integration of cognitive learning with affective learning. This environment will be considered in terms of its possible practical value to the classroom teacher for reinforcing the learning of certain concepts that are taught in all subjects in the curriculum.

Because the stimulus properties of this type of learning environment are highly varied and involve several sense modalities, the phrase "AESTHETIC LEARNING OPPORTUNITY" (ALO) was adopted. Using the ALO approach (environment) will in some cases take more time than the traditional method. However, this additional time becomes of less concern if comprehension and retention of the concepts being taught are strengthened and the individual is motivated to investigate other similar experiences. Furthermore, any gains in retention of information would eliminate time normally needed for the repetition of information presented.

Theoretical Basis

The notion of relating the arts to other subjects in the curriculum seems redundant to music and art educators who have been constantly supplying materials that are appropriate to the classroom needs for subject correlation. If, however, we consider the definition of "RELATING" as establishing a logical or causal connection between learning experiences and recognize that this process involves aesthetic behaviors that are common to the arts and other subjects in the curriculum, the statement takes on a meaning more relevant to education.

Relating is an essential part of learning that depends upon the degree of excitation of stimuli in the environment which act upon the individual's sensory receptors and the ability of the mind to perceive, evaluate and conceptualize these experiences.

All disciplines offer some degree of aesthetic experience, but the arts, because of their multi-stimulus properties and inherent aesthetic qualities, modify the behavior of the sensory receptors and therefore influence learning. One of the roles of the arts in education, then, could be to create an environment which offers the individual the opportunity to use all of his intellectual and physical powers to investigate certain selected concepts presented in all subjects taught in the curriculum.

The arts referred to here are those fields of study considered by some educators as having little or no practical value to our formal education process: visual and plastic art, creative dance (movement), music and dramatics.

The following statements by psychologists, educators, aestheticians and performers in the arts can be found to support the theory of relating the arts to other subjects in the curriculum. These statements, although not always based upon empirical evidence, clearly indicate the need for further investigation into the effect of an aesthetic experience upon the development of the individual's intellectual, physical, social and emotional growth within the framework of the educational curriculum. They also imply that perception and conception depend upon the emotional meaning of things, thoughts and actions and that these factors should play a vital part in the design

of the educational process.

Abraham Moles, one of the founders of Information Theory, considers the human being as a "receiver of two types of information; semantic and esthetic." Semantic information is "logical, structured, expressible, and translatable. It is logical in the sense that all the receptors of the message accept its rules and symbols." Esthetic information he says, "shapes states of mind. A message becomes personal in the field of esthetic information." The important point to consider here is that "if a message modifies the behavior of the receiver, the message will be more valuable - not just if it is longer, but if it is newer. (What is already known is presumably integrated by the receptor and belongs to his internal system.)" One of the principal results of Mole's study was that all messages include semantic and esthetic parts and that the two kinds of information interact. "In speech, he says, the two parts seem to play nearly equivalent roles. In music, the esthetic message is infinitely richer in elements and carries more information than the semantic message."⁴ This study, then suggests that an environment that is predominantly esthetic modifies the behavior of the receiver to a greater extent and therefore influences perception.

Abraham Moles speaks of information received by the receptors as symbolic in nature. Let us explore this notion further by a brief reference to Susanne Langer's theory of Symbolic Transformation.

⁴ Abraham Moles, Information Theory and Esthetic Perception (London: University of Illinois Press, 1966), pp. 19, 124, 167.

Susanne Langer says that "Ideas are undoubtedly made out of impressions - out of sense messages from the special organs of perception, and vague visceral reports of feeling." Furthermore, "The material furnished by the senses is constantly wrought into "Symbols", which are our elementary ideas."⁵ These ideas, she says, can be combined and manipulated with other symbolic materials existing in the mind, take on meaning through association and discrimination, and then conceptualized.

If we accept the notion that the symbolic attributes of the arts are aesthetic in nature and that aesthetic experiences include intellectual, physical and emotional behaviors, then through the process of "Transformation", as defined by Langer, the arts can be used as the media to create an "Aesthetic Learning Opportunity" in which conceptualization is reinforced. The ALO offers a challenge to the individual to become totally involved in his own learning process within the context of a self-initiated or teacher guided, aesthetic experience. The value of this kind of challenge lies in the fact that the student must rely upon his ability to investigate, create and initiate experiences that can be used to express his interpretation of concepts presented to him or conceived by him. This interpretation may take the form of substituting sound, movement or colors for words or by identifying the "self" with an object that represents a concept.

The existence of aesthetic experiences and a concern for its inclusion in the design of programs in education are expressed in the

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Susanne K. Langer, Philosophy in a New Key (Cambridge, Massachusetts: Harvard University Press, 1963), pp. 42, 43.

following statements made at the Tanglewood Symposium in 1967, as reported in a review by Murphy and Sullivan.⁶

"...aesthetic perceiving and creation and aesthetic peak experiences are seen to be a central aspect of human life and of psychology and education rather than a peripheral one." (Maslow)

"One of the stumbling blocks to aesthetic education is the relentless pressure on the child to be literal, factual, and scientifically terse..." These are indubitable virtues in modern man, and probably he could not survive without them, but if they do not wholly destroy the aesthetic capacities, they do inhibit the receptivity to the figurative, the imaginative, in short, the aesthetic mode of experience." (Broudy)

One paragraph taken from the Tanglewood Symposium Declaration, a document recognized as one of the most significant statements made by educators, seems appropriate here.

"The arts afford a continuity with the aesthetic tradition in man's history, music and other fine arts, largely nonverbal in nature, reach close to the social, psychological roots of man in his search for identity and self-realization."

Louise Yochim, in her book, Perceptual Growth in Creativity, says that:

Aesthetic education which involves intellectual or cognitive factors, sensation, imagination and feeling, heightens and refines sensitivity to the quality of experience. The aesthetic experience is a process and a process involves activity; when the educative process does not offer opportunity to cerebration and manipulate creatively, the individual's ability to project novel concepts and images may be limited.⁷

⁶ Judith Murphy and George Sullivan, Music in American Society, (Washington, D.C., Music Educators National Conference Publication Sales, 1968) Stock number 321-10334, pp. 27, 49, 56.

⁷ Louise Yochim, Perceptual Growth in Creativity, (Scranton, Pa.: International Textbook Co., 1967), Chapter I

D. W. Gotshalk, in the Journal of Aesthetic Education, writes on the subject, "Aesthetic Education as a Domain", in which he suggests that "...aesthetic experience and the values in aesthetic experiences can be adequately described in terms of intrinsic perception or perception raised to a major activity valuable in its own right..." Gotshalk further asserts that "Aesthetic Education can be combined very effectively with other forms of education such as science, history, mathematics, etc.; indeed, in most fields where reflection on an area of attention is central to education."⁸ This statement is based upon his theory of perception which includes sensation, intuition and intellect.

The above statements by Maslow, Broudy, Yochim and Gotshalk suggest that educational institutions re-evaluate their instructional objectives in terms of "aesthetic peak experiences" which offer the opportunity to free children from "literal and factual pressures" and to develop "sensitivity to the quality of experiences" and that Aesthetic Education is a domain in which experience-centered activities challenge the individual's sensory perception, imagination, intuition and intellect. It is within the domain of Aesthetic Education that learning experiences in the arts can be combined with learning experiences in other disciplines.

It was stated in the introduction of this chapter that although the ALO approach would involve an additional time factor, there would be gains in comprehension and retention of information presented and

⁸ D.W. Gotshalk, "Aesthetic Education as a Domain", The Journal of Aesthetic Education, Vol. 2, Number 1 (January 1968), p. 43.

and the individual would be motivated to investigate similar experiences. These three variables - comprehension, retention, and motivation - were considered valuable to this study because the educational institutions are constantly manipulating stimuli in the environment to effect changes in these three behaviors.

Benjamin Bloom, when speaking of changes in human characteristics, refers to environment as containing "conditions, forces and external stimuli which impinge upon the individual. These can be physical, social as well as intellectual factors which affect a particular characteristic." He further states that "The environment is a determinant of the extent and kind of change taking place in a particular characteristic."⁹ This implies that certain characteristics are changed by the degree of response to stimuli present in an environment and the motivational force of that stimuli. Support for this assumption can be found in Skinner's definition of motivation as "a general term that encompasses those states of the individual under which he attends to certain aspects of his environment. As a result, his behavior is both initiated and directed."¹⁰ Further support for this notion is stated in a review of experimental research related to the reaction of sensory mechanisms to stimuli in the environment by K.S. Lashley. His conclusions are that "motivation is influenced by instinct as well as by sensory mechanisms" and "that motivated behavior depends

⁹ Benjamin Bloom, Stability and Change in Human Characteristics, (New York, Wiley Publishing Co., 1964), p. 187.

¹⁰ Charles E. Skinner, Educational Psychology, (Englewood Cliffs, New Jersey: Prentice Hall, 1959), Fourth Edition, p. 396

not upon a single stimulus but rather upon a complex pattern of stimuli, even when a single stimulus triggers the response." Lashley also refers to motivation as "a reaction to a deficit in experience" and that "An increase in general activity or in exploratory behavior indicates an increased responsiveness to stimuli not obviously related to the specific sensorimotor patterns of the instructive behavior."¹¹

Retention, another variable considered in this study is described by Skinner as the "sustained cumulative effect of training." He also says that "Effective retention depends upon the development of many meanings and relationships in learning materials. Organization of subject matter into large, significant units, in which various subordinate points are related to the whole, as an effective way of making learning permanent."¹²

More important, is the statement that "The learning process includes both acquisition and retention. These two processes are so closely related that in reality, when acquisition is measured, retention is also measured: for without retention of the effects of previous training, no progress could be made during successive training periods."¹³

If the process of learning includes something more than the acquisition of facts and skills such as the ability to draw inferences

¹¹ K.S. Lashley, "Experimental Analysis of Instructive Behavior", Psychological Review, Vol. 45, No. 6, November 1938. pp. 467-469

¹² Skinner, op. cit., Third Edition, p. 302

¹³ Ibid.

from known data, and to relate these ideas to new experiences, and reach a conclusion based upon the process of investigation and evaluation of these experiences, the term comprehension seems appropriate as the third dependent variable to be considered in this study. Comprehension, then refers to an individual's "mental capacity to perceive and understand; the power to grasp ideas."¹⁴ Comprehension is measured in terms of the student's ability to act, feel and think intelligently to a situation.

It is possible to assume at this point, based upon the previous statements, that an ALO environment could effect certain human characteristics such as comprehension, retention, and motivation if it is designed to include multi-complex stimulus properties and organized subject-matter units that show a relationship between its parts and the whole.

Statement of the Problem

The purpose of this study is to determine to what extent an Aesthetic Learning Opportunity (ALO), in which the arts are used to teach one aspect of an academic discipline, will effect changes in motivation, and comprehension and retention of information in selected groups of students.

Commonalities and differences in performance of members in an experimental group and control group were compared in terms of motivation, comprehension and retention of information. The experimental group was taught certain basic geometric concepts using an ALO method and the control group was taught the same concepts using a traditional text,

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"Comprehension", Webster's International Dictionary (Springfield, Massachusetts, Second Edition, 1956), p.

workbook, lecture method.

Definition of Terms

The word "aesthetic" has been defined in the previous discussion of the theoretical basis for this study; however, it seems appropriate to define it again for purposes of clarification, especially as it is used in the ALO.

Webster's International Dictionary states that the word aesthetics "was first used by Baumgarten in 1750 to designate the science of sensuous knowledge, whose goal is beauty, in contrast with logic, whose goal is truth."¹⁵ This definition remains valid with the addition of a refinement of sensuous knowledge as the result of the interaction of the intellectual, physical and emotional behaviors of the individual.

"Aesthetic" is used to describe the sensuous characteristics of an object which is perceived by the sensory receptors of the individual and interpreted as having certain acceptable, pleasurable elements for consideration. It is used as an adjective with the word "experience", to indicate that the receiver is making an effort to perceive the sensuous characteristics of objects that directly affect his intellectual, physical and emotional reactions.

In addition to defining aesthetics, it seems fitting at this point, to quote the following statement made by D.W. Prall in his book, Aesthetic Analysis:

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"Aesthetics," Op. Cit., pp. 77-78

Gaining knowledge is an experimental venture, not a dream, nor a logical demonstration. And if we are to get knowledge in the field that we have suggested as that of aesthetics, we shall have to venture upon abstracting elements from experience that seem to us to the purpose, and upon discriminating such relations among elements as appear to us to be relevant to the actual nature of the aesthetic objects that we know.¹⁶

The phrase "Aesthetic Learning Opportunity" (ALO), used in this study, refers to a learning situation where the stimulus properties are highly varied and involve several sense modalities. The arts, because of their potential for presenting stimuli that appeal to so many sense modalities, have been adopted as the media for creating an ALO. The stimulus properties of art media and materials impinge upon several sense receptors simultaneously and thus tend to involve "more" of the organism than a stimulus which concerns only one receptor.

The term "arts" refers to the generally considered non-academic disciplines, such as visual and plastic art, music, creative dance (movement) and dramatics. The lyrics used with music and the dialogue used in the dramatic presentations are considered as an integral, stimulating part of these art forms.

The ALO is used in this study as both an environment and an approach to teaching. The ALO is an approach when the teacher meaningfully directs and suggests certain activities that free the student from perceiving his environment within the limits of verbal description and when the teacher encourages the student to initiate his own activities for invest-

igation. The role of the teacher is to help the student develop motor skills that will increase his interest in a variety of simple and complex experiences in the arts, to develop the ability to recognize the relationship of these experiences to the subject-content-concepts presented for investigation and to use these experiences in the arts to communicate the concepts to others.

The ALO is also an environment which offers the individual the opportunity to use the arts as media for interpreting and expressing the concepts presented. The atmosphere of the ALO environment must be conducive to both the teacher and the students' uninhibited, active participation and involvement. A room meeting this requirement should have space enough for freedom of movement and investigation of materials in all art forms as defined.

The arts in the ALO should be considered in their broadest definition, a rule which seems to be in keeping with the most recent trends in education. A short review of the arts as media is presented here.

Music is no longer limited to the definition of organized sound having rhythm, melody, harmony and meter. The advent of electronic equipment and studies such as the Manhattanville Music Curriculum Program has added new dimensions that personalize musical experiences. The electronic synthesizer offers a choice of a single or complex sound which can be manipulated and mixed with voices, or other instruments found in the individual's real world. One way of using the synthesizer is as the medium for creating a composition that describes geometric concepts. The Manhattanville Curriculum relies heavily on teaching musical concepts through "sound" discovery. It is also a method of exploring "self" through the arts.

Children explore sound and then use it to express their impressions and interpretations of objects found in their surroundings or concepts conceptualized through experience. Exponents of the visual and plastic arts in education recognized the need for a realistic view of the individual's cry for complete freedom of expression, exploration and investigation through the use of materials at hand earlier than most educators. Public school music programs, for example, until recently followed a formal teaching approach which limited self expression through the use of strict melodic and rhythmic patterns and structured harmonic progressions. The freedom to search for self identity is a natural outgrowth of the philosophy of the art itself that the creation of a work is not to communicate ideas to others but to express the inner-self for self's sake. Musicians have their "soul" music, artists have their "soul" art. Freedom to explore concepts using the visual and plastic arts is an important ingredient of the ALO approach to teaching. The biological process of photosynthesis could be expressed by one or a group of students by using clay, plastics, paint, collages or any material at hand such as chairs, desks, etc.

Dance is movement whether teacher directed or student initiated. Movement becomes creative when the individual uses it as a personal experience for free interpretation of what he perceives. The Jacques-Dalcroze Eurhythmic method for teaching music "...uses the body as a musical instrument to interpret musical sounds."¹⁷

The physical involvement of this method as a means of interpretation is the key to its success. Similar teaching techniques of this method can be an important part of the ALO approach proposed by this study. For example; movement with or without sound can be substituted for words found in science or geometry. Words like: "density" or "congruency" can be interpreted through movement. How would one move in a large vat of thick liquid? (Music or body sound can be used with the movement.) What body movement would express the concept of congruency?

The most recent thrust in dramatics is toward the development of the individual's awareness of his own identity and the world around him. An analysis of his reaction to people, things, and situations helps break down his inhibitions that stifle interpretation, initiative and creativity. All the senses are used to influence behaviors which are never considered right or wrong but as natural reactions to situations.

Creativity is encouraged by the teacher presenting problem solving situations not merely to communicate the solution to others but to feel the intensity of the problem within the mental, emotional complexity of the human being. To really be someone or something else can be a very personal, emotional experience and still involve the intellectual process. To place dramatics in the context of an educational experience, we must consider both its aesthetic and intellectual values. To "be" a seed that grows to be a plant through the process of photosynthesis could be a more meaningful experience for a child than just reading about it and seeing pictures in a book.

All of the previously mentioned aspects of the arts are included in an ALO environment. It is clear that the teacher of any subject using this method must be aware of these philosophies and be willing and able

to create and initiate activities the art forms represent. Participation in the activities with the students with meaningful suggestions that are not too explicit is extremely important to the success of this program. It is this factor of active involvement in an art-medium-created ALO which has been selected as the important ingredient of an aesthetic experience that has valuable implications for the teaching and learning process.

The ALO teaching approach is not as open-ended as it might appear. It could be considered as an "open-means" approach where the activities outlined for the student, although exploratory in nature, are stated in terms of instructional objectives as defined by Elliot W. Eisner.

First, they should describe what the student, not the teacher, is to be able to do. Second, both the behavior of the student and the content in which it is to be displayed are to be identified. Third, the context for assessing the behavior is to be described. Fourth, instructional objectives should be sufficiently specific to refer to observable behavior and not to non-empirical mentalistic events.

Eisner further suggests additional consideration of objectives in terms of the "...outcome of an encounter or learning activity that is planned to provide the student with an opportunity to personalize learning." Personalized learning is described as intellectual and emotional immersion of each individual in his own learning activity. "Expressive" objectives, he says, are more difficult to describe in advance however, because "...of the richness of these encounters or activities and the unique character of their outcome."¹⁸

The theory of "Relating the Arts to Other Subjects in the Curriculum" is based upon a humanistic approach to teaching subject content in an aesthetically designed learning environment. The focus of this approach is on the physical, intellectual and emotional development of the individual and on a concern for a curriculum which offers a greater opportunity for students to become totally involved in their own learning experiences.

The following statement by Dr. Harold Taylor will serve as a summary of the introduction to this research investigation.

The activity of thinking begins when an individual is impelled to think by the presence of questions which require answers for him. He begins thinking when he is involved in experiences which require him to place these in some kind of order. Until the individual becomes sensitive to experience and ideas, until they mean something to him personally, until he becomes conscious of the world around him and wishes to understand it, he is not able to think creatively about himself or about his world. His sensibility, his values, his attitudes are the key to his intellect. It is for this reason the arts, since they have most directly to do with the development of sensibility, are an essential component of all learning.¹⁹

Before closing this chapter, it is important to make clear that the proposed AIO approach to teaching would not be a substitute for existing instrumental and vocal music or art programs in the schools. These disciplines are necessary for the maintenance of the performance qualities of these arts. It is hoped, however, that results of this study will generate more interest in the integration of the arts within the general curriculum as the media for reinforcing the learning process. In this sense,

art, music, movement and dramatics should not be taught on a structured time allotted basis but when it seems appropriate to use them as reinforcing agents to learning.

CHAPTER II

RELATED LITERATURE

Using the arts as the media for presenting and exploring concepts in other subjects proposed by this study - such as congruency in geometry, ostracism in social studies, or erosion in science - although not completely excluded from the thinking of investigators, does not seem to be the basic objective of research efforts at this time.

Centers for Aesthetics in Education are including seminars in their programs that are designed to help determine the feasibility of using the arts as the media for creating a more aesthetic approach to education. But these centers, for the most part, are limited to studies of aesthetic theories and philosophies and related arts programs -- with little emphasis on their application to interdisciplinary classroom instruction. Statements by educators do, however, suggest the need for aesthetic inquiry through the use of an experiential-discovery-teaching-technique.

Aside from the teacher, the means and ends of aesthetic education are rooted in the actual experience with musical elements and critical types of related activity. The experiential approach so vital to aesthetic perception in general, has significant pedagogical value because of its potential to stimulate exploration and behavioral change. Further, a learning theory rooted in the methodology of personal discovery would be most consistent with our means and ends.

Discovery method is well suited for the development and testing of concepts, and for the cultivation of discrimination. Its reliance on research and creativity sets it apart from more traditional deductive and inductive methods. Discovery method generates the setting for learning experiences by means of leading questions, musical problems, and other resourceful challenges that invite thinking about and experience with musical ideas.

²⁰ Abraham A. Schwadron, Aesthetics: Dimensions for Music Education, Music Education National Conference, 1201 Sixteenth St. NW, Washington, D.C. 20036 (1967) Catalog Number 67-19570, p. 109

One of the proposed requirements for an AB degree in Aesthetics in education at the University of Massachusetts School of Education is a course called "Concept Teaching Through Aesthetics." This undergraduate course is the outcome of an Initial Executive Planning Committee report on a curriculum for "Aesthetics in Education" in which one of the objectives is to apply the principles of aesthetics in concept teaching. The rationale of this report includes "the proposition that fundamental concepts of the academic disciplines may be taught with aesthetic principles in mind." The report continues to state that "concepts are chosen for their value as fundamental insights of one or another of the disciplines -- fundamental in the opinion of specialists in the field." The basic outline "presumes that teaching candidates will be introduced to the proposition that concepts of the academic disciplines may be taught through artistic media and will be encouraged to include their pedagogical thinking in the use of conflict resolution as a teaching alternative."

The following is an example of concept teaching as suggested by the curriculum outline:

"Concept to be taught: A given tree's growth is controlled by the supply of air, water, sunlight, and soil nutrients available to it.

- a. Given four colors (paint, chalk, colored paper) create a design giving the impression of strength with a balance of each color.
- b. Given four colors (paint, chalk, colored paper) create a design giving the impression of weakness in which one or more of the colors is slighted in favor of the others.
- c. Choose a series of well-known tunes and demonstrate how each can be weakened by changing either the rhythm or the phrasing."²¹

²¹Center for the Study of Aesthetics in Education, Undergraduate Courses and Programs in Aesthetics in Education, Initial Executive Planning Committee Report, University of Massachusetts School of Education. (Mimeograph) p. 8

A written evaluation of the outcome of this course is not available at this time. A discussion with Mr. David Lepard, assistant director of the center, revealed that the students and instructor are extremely excited about applying principles of aesthetics in concept teaching and have spent several weeks in planning concept-exploration-experiences for students who will enroll in the course for the spring semester 1971.

The following literature, although not directly related to the stated problem of this study, does include investigations of the value of certain characteristics of the ALO to the development of intellectual and physical skills needed in several areas of learning. They also suggest further consideration of experimentation and research in the field of interdisciplinary (aesthetic) experiences in education.

In a short article, "Singing Helps Children Learn to Read," Gladys C. Uhl writes about elementary school children's musical experiences and how "Music develops their listening ability and auditory acuity. While these skills are essential for a child's appreciation of music, they are also essential for the child who is learning to read. Texts for elementary teachers constantly emphasize the importance of auditory acuity in the reading readiness program." She quotes a study by Tinker and McCullough in which four important factors were considered for successful reading in grade one. '(a) Auditory discrimination ability, (b) visual discrimination ability, (c) range of information and (d) mental age. Of these factors auditory discrimination ranked first in its influence on learning to read. 'Music, Uhl says, "...influences the student's field of concentration and auditory acuity. The concentration required to learn a song by rote is the same as that required to pick up the sound of a spoken word. Because the teaching of singing is directly concerned with

the teaching of vocal sounds, singing becomes the teaching of an essential skill."²²

The Orff-Schulwerk, Bellflower, California Project, conducted under title III USEA of 1965, was a two year experiment directly concerned with the application of the Orff philosophy of Music Education to the public schools in the United States.

The Orff-Schulwerk, through the use of "elemental instruments, especially the bar instruments (stabspiele) introduces the scales and intervals through listening, looking and touching." This method is "a new form of speech-training and new contracts between speech and music; so it is possible to introduce rhythm, meters, motives, bar accents and species of time by means of the sound and rhythm of words, names, sentences, maxims and poems." The Orff-Schulwerk method "contains a collection of models for singing, playing, and improvising elemental music and to realize scenic music-and-dancing games or pieces for an elemental music theatre."²³ Children are encouraged to invent, improvise, and develop their own musical experiences that coincide with words and speech patterns found in their everyday living experiences.

The Bellflower Project included a short statistical analysis of the correlation of the Orff approach to teaching music with reading ability.

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Gladys C. Uhl, "Singing Helps Children Learn to Read", Music Educator's Journal (December 1969), p. 45

23

Wilhelm Keller, "What is the Orff-Schulwerk and What is it Not?", Lecture at Orff-Kodaly Teacher Training Workshop, Dana School of Music, Wellesley, Massachusetts, (July 15, 1969) (Mimeograph)

A comparison of Orff-Schulwerk and non-Orff-Schulwerk groups was made on the basis of the California Stanford Reading Test. Orff-Schulwerk groups showed significantly higher reading scores in the 1st and 2nd grade, while the non-Orff-Schulwerk group had significantly higher scores at the 4th grade level. At grades three and six there was no significant difference of the two groups.

Some interesting observations of students' and teachers' behaviors were made during this study.

Pupil behavior showed the biggest increase in expressive movement, development of time and space relationship, locomotor proficiency, and improvisation of concepts or activities in either the verbal or motor domain.

Teachers became more sensitive to the interests and participation of children; children reacted with more enthusiasm and response to oral, instrumental and rhythmic activities; ---increase of expression and spontaneity, developed a climate in which self-expression was reflected in many aspects of the school program such as writing, creative poetry, oral language and freedom of movement in dramatic and physical education activities.²⁴

Nancy Ferguson, a music teacher and student of the Orff-Schulwerk, used the Orff approach of teaching music to eleven perceptually handicapped boys whose ages ranged from seven to ten years old. After a short period of six months the boys were able to "...read simple music independently, play simple patterns on the recorder, (a small wind instrument) improvise melodically, vocally and instrumentally and sing with good tone quality." Ferguson was encouraged to try this experiment because of statements by Hebb and McConnel, specialists in Special Education. Ferguson quotes Hebb as saying that 'repeated stimulation leads to development of "cell assemblies" which when repeatedly activated as a result of

²⁴ Bellflower Unified School District, Design for Creativity, (Orff-Schulwerk), Report to the U.S. Office of Education, Grant #OEG 4-6-000257-0356-(056), Bellflower, California (1966)

specific motor response can cause neurological growth and learning.' She also quotes McConnell who says that 'a fifteen to twenty minute structured sensory perceptual training period together with a language instruction period may be expected to combat retardation of culturally disadvantaged children.'²⁵

An experimental research project was conducted in Budapest, Hungary from 1962-1966 by Mrs. Klara Kokas and Dr. M. Rittinger, exponents of the Kodaly philosophy of teaching music to children. This philosophy maintains that "The human voice, being available to everyone, free, and still the most beautiful instrument, can be only the real foundation of a general and all-out musical culture."²⁶ Kodaly also believed that "...music should also serve an educational purpose, and his efforts won recognition that music was not a luxury or entertainment subject, but that it was a vital part of the academic curriculum and that it plays a vital role in developing an educated person, educated as a whole human being."²⁷

Denise Bacon, director of the Kodaly Institute in Wellesley, Massachusetts in a short paper "The Kodaly Method in Relation to Total Education", refers to a statement concerning the Kodaly philosophy made by

²⁵ Nancy Ferguson, "Orff with the Perceptually Handicapped Child", The Orff Echo, Official Bulletin of the Orff-Schulwerk Association (Vol. 2, No. 3, June 1970) p. 1

²⁶ Klara Kokas, "Psychological Tests in Connection with Music Education in Hungary", Report to International Seminar on Experimental Research in Music Education, University of Reading, England (July 9-16, 1968) Kodaly Institute Dana School of Music, Wellesley, Massachusetts (Mimeograph)

²⁷ Peter Erdei, "About the Philosophy of the Kodaly Method", Lecture at Ithaca State College Workshop Dana School of Music Teacher Training, July 14-26, 1969. Dana School of Music, Wellesley, Massachusetts. (Mimeograph)

Dr. Joseph Szarka, head of the Pedagogical Institute in Budapest, Hungary.

"According to Dr. Joseph Szarka, ...there are six areas in which a person must be educated. They are 1) the intellectual 2) the moral or ethical 3) the emotional 4) the physical 5) the aesthetic 6) the political. ...Among the reasons why music plays such an important part in the total curriculum here, Dr. Szarka said that music was the only subject which touched upon every one of these six areas. Whereas math and language affect the brain, literature the moral, history and literature the aesthetic, music affects every one of these six fields."²⁸

The Kodaly method of teaching music includes singing, (folk songs, games and solmization) movement, clapping rhythms and using hand signals. Music books are available that offer vocal and rhythm exercises and songs. These books are used by the teacher as a guide to learning and are not meant to stifle the creative abilities of the children. Peter Erdei speaks of creativity as non-existent without discipline. He believes that "if one knows the material, he has every tool at his disposal to create, to be truly himself. In the Kodaly Method, much emphasis is placed on creativity - it is not unusual to improvise a folk song type of melody, or an eight measure period, and in the upper classes to add harmonies to it."²⁹

The research procedures and statistical analysis of the data from this study are not available; however, "Results of tests carried out during the period of 1962-66 were reported at the Budapest (1965) and Interlochen (1966) ISME conferences. These tests have shown remarkable difference in rhythm, sound observation, gymnastics, and arithmetic abilities

²⁸ Denise Bacon, "The Kodaly Method in Relation to Total Education", Kodaly Institute Dana School of Music, Wellesley, Massachusetts, (June 17, 1968) (Mimeograph)

²⁹ Erdei, loc. cit.

of school children in groups of special music education. Also somatic tests made by anthropologists, ...reported high values in chest expansion and vital capacity of musical groups."³⁰

Because movement is another important ingredient in the ALO proposed by this study, it seems appropriate to include a short review of the Dalcroze eurhythmics method of teaching music by Judith Willour, written for the Music Educator's Journal. This method's primary purpose is to develop a "...feeling for and an awareness of music through body movement. In this system of rhythmic re-education, originated by the Swiss musician Emile Jaques-Dalcroze (1865-1950), the body is actually used as a musical instrument in interpreting the sounds." This method was designed to "...create, by the help of rhythm, a rapid and regular current communication between brain and body and to make feeling for rhythm a physical exercise."

The Dalcroze method appeals to the individual's rhythmic sense, musical ear, the voice and muscular coordination simultaneously through various body activities. The pupil's powers of attention and concentration are developed by using the arms to beat one rhythm while the other part of the body moves to the basic pulse of the music. This technique is expanded to include the learning of note values and form through visual aids such as music symbols printed on cards, lines on the floor and rubber balls. This experience goes "beyond its musical implications. The activities can contribute to a child's total personality by encouraging imagination, and creative response. Eurhythmics offers a variety of ways

³⁰Kokas, loc. cit.

for a child to express himself and therefore, can influence his temperament and his psychological development."³¹

This method has been incorporated into many music classes by music teachers in the U.S. where there is sufficient room to move and when the teacher has the necessary skills in movement.

This chapter would not be complete without mentioning the controversial issue of the role of the arts as a part of - or a part from - the humanities programs. It is not the intention of the writer to take sides with this issue but because this study does imply a closer relationship of the arts to all disciplines in the curriculum it is considered an important part of the review of literature.

Joseph C. Sloane, Professor of Art and Director of the William Hayes Ackland Memorial Art Center, discusses the problem "The Arts and Humanities: Brothers or Strangers." Sloane considers the distinction between the arts and humanities due to the fact that "To some educators, the term 'humanities' unquestionably includes the arts in their performing and producing aspects. These people would find any other interpretation erroneous. But in spite of such convictions, the facts are that in many minds, the two are separate and very possibly antithetical as well. If humanists include the arts in their interest, they often do so with careful reservations, while artists frequently indicate a cheerful willingness to dispense with the humanities altogether." Another indication of complete separation is in the establishment of two separate "Endowments" for the National Arts and Humanities Foundation. The central board of this foundation

³¹Willour, loc. cit.

seems to be at opposite poles. According to Sloane's statement "We are faced with a deep-rooted division that refers to nothing less than two basic and often opposed characteristics of human mind. To expect that they can be fused is unrealistic."³²

An article by Michael E. Cleveland, "Let's Give Humanities the Choice it Deserves", expresses a more tolerant view of the arts and humanities program. He suggests a greater effort by educators in the arts to become part of the staff that develops and teaches humanities that are primarily dominated by teachers in English, Social Studies, and History. He believes that "there is no reason why this must have been so, or should continue to be so. Given the time, effort and funds for training, there is little doubt that the instruction of music within high school humanities courses can be vastly improved. Cleveland states that the arts have been left out of some humanities programs because "music specialists have often found it difficult to function within such a course. This may perhaps be due to inherent weaknesses within the course, but it may also be due to the fact that some music specialists by virtue of their training, find it difficult to deal with the general student who does not perform." He maintains that there is a greater need for a broader understanding of the "nature of the arts" not only by music specialists but by humanities teachers. He quotes three levels of understanding from Aaron Copland's book, What to Listen for in Music. These three levels are 'the sensuous, expressive and the sheerly musical levels. The sensuous level is passive,

³²

Joseph C. Cloane, "The Arts and Humanities: Brothers or Strangers", Music Educator's Journal (September 1967), p. 38.

the second involves a search for the meaning of the music and the third is structural content." All three levels, Cleveland says, are important elements for consideration in the related arts and humanities programs. "The humanities teacher should be given special training to enhance and enlarge his perceptual ability in music."

Although the author of this article refers mainly to music and art, he implies that the rejection of any effort to combine the related arts with humanities courses "at this time amounts to an unintellectual, emotional way of problem solving - ignore it and hope it goes away."³³

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Michael E. Cleveland, "Let's Give Humanities the Chance it Deserves", Music Educator's Journal (September, 1970), pp. 55, 99.

CHAPTER III

PROCEDURE

Restatement of the Problem

The purpose of this study was to determine to what extent an Aesthetic Learning Opportunity (ALO), in which the arts are used to teach one aspect of an academic discipline, affected changes in motivation, comprehension, and retention of information on selected groups of students.

Commonalities and differences in performance of members in an experimental and control group were compared in terms of motivation, comprehension, and retention of information. The experimental group was taught selected geometric concepts using the ALO method and the control group was taught the same geometric concepts using a traditional text, workbook, lecture method.

Statement of Hypotheses

This study is concerned with the following hypotheses which seem promising from the point of view of the literature reviewed:

- H 1. That the ALO method will produce a higher level of comprehension than the traditional method.
- H 2. That the ALO method will produce a higher level of retention than the traditional method.
- H 3. That the ALO method will produce a higher level of motivation than the traditional method.

The above hypotheses are statistically treated in the operational, null form. If the null hypotheses are rejected, the alternatives, as stated, are accepted.

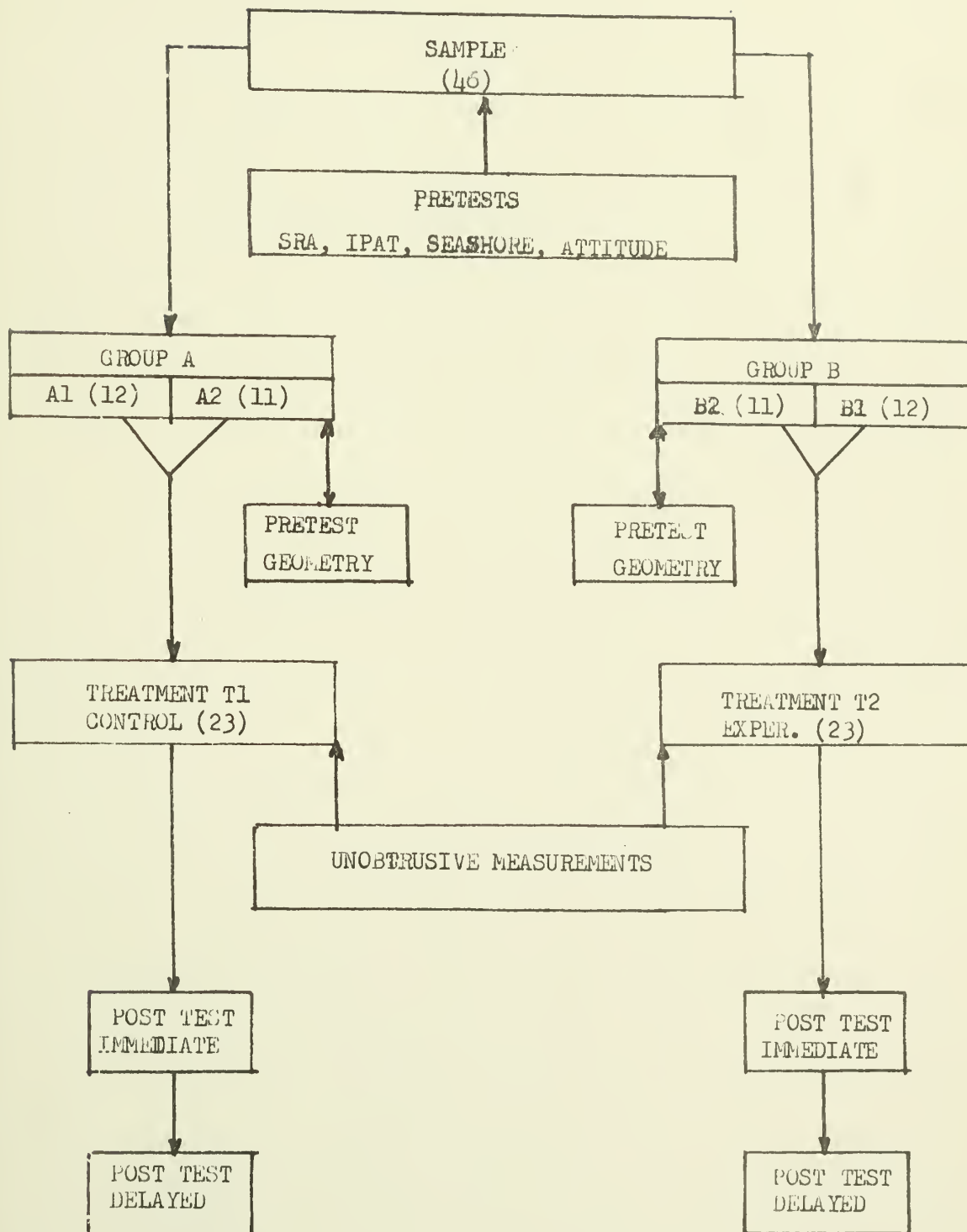
Other relationships between variables were investigated.

- 1. Attitude toward the arts and achievement.
- 2. Musical talent factors and achievement.
- 3. Personality traits and achievement.

RESEARCH PROJECT MODEL

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FLOW CHART



Selection of the School.

Wheelock Elementary School in Keene, New Hampshire was chosen for this research project. This school is part of the Keene City School System and is used as a training center for students enrolled in the Elementary Teachers Training Program at Keene State College. It represents a typical educational system that is making an effort to change its instructional objectives to meet the intellectual, physical and emotional needs of young children within a growing community that maintains a traditional educational philosophy.

Selection of the Population

Students 9 to 11 years of age were selected to serve as subjects for the experiment. This particular age group was chosen because of the evidence indicating their responsiveness to environmental changes.

The following statements by Bloom and Skinner indicate that the age group 9 to 11 might be a more appropriate, fruitful, target population to work with than other age groups.

Although there is relatively little evidence of the effect of changing the environment on the changes in intelligence, the evidence so far available suggests that marked changes in the environment in the early years can produce greater changes in intelligence than will equally marked changes in the environment in later periods of development.³⁴

For most children, the preadolescent years are productive, a period of rapid growth in behavior organization, and are not beset with the problems of adjustment characteristics of either early school or adolescence.³⁵

Selection of Tests

The total population of 46 fourth grade students was given four tests prior to the treatment: An Attitude Questionnaire, constructed by the investigator, the SRA Primary Ability Test, the IPAT Personality Questionnaire, and the Seashore Musical Ability Test. Eleven subjects of the experimental group and eleven subjects of the control group were randomly selected and administered an achievement test by the investigator prior to their respective treatments. This achievement test was also constructed by the investigator. Samples of the Achievement Test and the Attitude Questionnaire can be found in the appendix.

Data collected from these tests were used to equate the two groups on the basis of chronological age, mental age, IQ, attitude, and knowledge of geometry before treatment and to investigate the effects of the treatments on the experimental group and the interaction of individual and group differences with the treatments.

Achievement Test. An achievement test consisting of three parts with a total of 45 items was constructed by the author. Part I has 15 multiple choice items, Part II has 15 true or false items, Part III asks the student to draw specific geometric figures with ruler and pencil.

³⁵

Charles Skinner, Essentials of Educational Psychology (2nd edition) (Englewood Cliffs, New Jersey: Prentice Hall, 1950), p. 97

Each item was related to information presented in the student text-work-book and the common objectives for the control and experimental groups.

This test was used to collect data in three different ways: (1) to pre-test eleven students of each group (randomly selected) for knowledge of the geometric concepts before the treatment, (2) a post-test of total experimental and total control groups for comprehension of the geometric concepts after the treatment and (3) a delayed post-test of the total experimental and total control groups for retention of the geometric concepts.

If the 45-item test in geometry was given to the total control and the total experimental group it would constitute a learning experience and it would be difficult to determine to what extent the test influenced student's comprehension of information being taught in their respective treatments. Therefore, an achievement test, made of 5 items from each of the three parts of the 45-item test, was administered to eleven randomly selected subjects from each group. The data collected from the sub-group A^2 and B^2 were used to determine how well matched the total control and total experimental group were in terms of knowledge of geometry prior to treatment.

A reasonably acceptable degree of content validity for the 45-item achievement test was based on a correlation analysis between the test content and the instructional objectives. This procedure included the comparison of total gains on the post achievement test and the projected instructional objectives that were reached at the end of the project.

The test-retest Product-Moment Correlation Technique was used to estimate the reliability of the 45-item achievement test. The correla-

tion coefficient of $r = .78$ was obtained for 30 pairs of scores with an interval of one week. This correlation is significantly different from zero at about the $p = .002$ level.³⁶

Attitude Questionnaire. The attitude questionnaire was designed by the investigator. It consists of 20 questions that force a choice between objects and activities that represent interest in the arts or objects and activities that represent interest in geometry. There are 5 choices to make between art and geometry, music and geometry, dance and geometry and dramatics and geometry. If the student chose to draw geometric figures rather than sing he was given one point in favor of geometry. Information from this questionnaire is treated statistically in Chapter IV.

The author was aware of the difficulty of validating such a questionnaire in terms of the attitudes it measured; however, it was evident that even a minor indication of a negative or positive attitude toward the arts or geometry would provide a useful basis for examining the influence of attitudes upon changes in individual and group behavior during and after the treatments.

Robert F. Mager supports the need for the consideration of attitudes toward school subjects in the statement:

Favorable attitude toward school subjects maximize the possibility that a student will willingly learn more about the subject, remember what he has learned, and use what he has learned.³⁷

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G. Milton Smith, A Simplified Guide to Statistics for Psychology and Education (Fourth Edition) (New York: Holt, Rinehart and Winston, Inc. 1970), p. 157.

37

Robert F. Mager, Developing Attitudes Toward Learning, (Fearson Publishers: Palo Alto, Calif., 1968), p. 11.

Corcoran and Gibb, mathematicians, state their belief that:

If students' attitudes toward mathematics learning are important, both as indicators of what they have learned and as elements in motivation for further learning, attitude appraisal should not be left out of the evaluation program.³⁸

The criterion for the validation of this questionnaire is the relationship that would be expected to exist between the attitude measured and other behaviors that can be observed, and then to test whether or not these predictions are borne out by the evidence.

The unobtrusive measures included in the research design, such as library and additional session attendance, were used as part of the validation observations procedure.

The results of this analysis are discussed in Chapter IV.

Three methods were used to estimate reliability of the attitude questionnaire: (1) the Kuder-Richardson formula 21;³⁹ (2) the test re-test Product-Moment Correlation Technique;⁴⁰ and (3) a formula for determining the relationship of reliability to length.⁴¹ Using the first method, the reliability coefficient is .87 while the standard error of

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The National Council of Teachers of Mathematics, Evaluation in Mathematics (Washington, D.C. 1201 Sixteenth St., Library of Congress Catalog card number: 61-11906, 1961) p. 121

39

Thorndike and Hagen, Measurement and Evaluation in Psychology and Education (New York: John Wiley and Sons, Inc., 1969) p. 185

40

Smith, loc. cit.

41

Thorndike and Hagen, op. cit., pp. 191-192

measurement is 1.9. The second method revealed a correlation coefficient of 4.183 for 30 pairs of scores with an interval of 1 week. This correlation is significantly different from zero at about the $P = .002$ level. For the third method, the formula suggested by Thorndike and Hagen was used. The reliability coefficient of the same test with 100 items is 1.25.

Mental Ability Test. The SRA Primary Mental Abilities test⁴² (revised 1962) for 4-6 grade level students was selected to find the IQ of each subject in the control and experimental group and to determine how well matched the groups were in terms of IQ.

The validity of the PMA test was established by SRA through a correlation coefficient computation between PMA IQ scores with the overall grade point averages of students in each grade, a correlation with other tests and a correlation with specific subject areas.

The reliability of this test was based upon a one week and four week test-retest median coefficient computation using 33 fourth grade students. The subtest total for one week was .93 with a standard error of measurement of 3.9 and the subtest total for four weeks was .94 with a standard error of measurement of 4.0.

Personality Questionnaire. The IPAT 14 Factor Personality Questionnaire⁴³ forms A and B for ages 8-12 was selected to collect data

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Thelma Gwinn Thurstone, Primary Mental Abilities (Chicago, Ill. 259 East Erie St. Science Research Associates, Inc., Revised 1962)

43

R.B. Porter, R.B. Cattell, Children's Personality Questionnaire (Champaign, Ill. Institute for Personality and Ability Testing 1963)

that could be used to determine to what extent certain personality traits affected a student's ability to comprehend and retain information within his respective group. We may hypothesize that a student with ego weakness tendencies would make greater gains in comprehension and retention of the subject matter in the experimental group than a student with similar tendencies in the control group, because the ALO environment offers greater freedom for self expression.

Concept validity was calculated in three ways: (1) by the multiple correlation of the 10 items in each factor with the pure factor; (2) from the equivalence coefficient "assuming that, by reason of suppressor action, the two halves of the test have nothing in common except the common factor they set out to measure; (3) a circumstantial or indirect validity which is the pattern of relationships between the factor of interest and the other personality and general ability factors defined in the questionnaire.

There are four types of reliability coefficients presented for each of the 14 factors for Forms A and B; however, only the Stability Coefficient (test re-test) will be stated here. Stability coefficients based on a two week interval for Forms A and B range from .52 to .83 with a median of approximately .70. The reliability coefficients of this questionnaire, although only based upon 10 items for each factor, were reasonably good enough to indicate the use of the data for this study.

Musical Talent Test. The Seashore Measures of Musical Talents⁴⁴

⁴⁴C.E. Seashore, Measures of Musical Talent (New York: Psychological Corp. 304 E. 45th St. 1967)

was selected to investigate the effect of certain musical abilities such as Pitch, Loudness, Time, Rhythm, Timbre and Tonal Memory upon a student's ability to comprehend and retain information within his respective group. We may hypothesize that a student with a high score on the Pitch test would make greater gains in comprehension and retention of the subject matter presented in the experimental group than a student with similar high score on the Pitch test in the control group because the ALO environment offers multi-sensory immersion that appeals to the individual's process of acquiring knowledge.

Seashore states his view of the validation of this test when he says:

Measures of Musical Talents have been validated for what they purport to measure ...When we have measured the sense of pitch; that is, pitch discrimination, in the laboratory with high reliability and we know that pitch was isolated from all other factors, no scientist will question but that we have measured pitch.⁴⁵

The reliability of the Seashore Measures of Musical Talents was estimated by using the Kuder-Richardson formula 21. The coefficients of reliability for grades four to five are: Pitch .82, Loudness .85, Rhythm .67, Time .72, Timbre .55, and Tonal Memory .81.

Administration of Tests

All tests and questionnaires were carefully examined and administered to the subjects by the fourth grade teachers of Wheelock Elementary Laboratory School and the project director.

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Seashore, op. cit. p. 7

Unobtrusive Measures⁴⁶

In order to secure unobtrusive measures on the effects of the ALO, additional opportunity was offered to students for further investigation of the same type of treatment they received in their respective groups at two Saturday morning sessions during the project schedule.

Books, films, records, pictures and periodicals that were related to geometry were placed on reserve in the school library and available to all the students in the experimental and the control group. The students' attendance at the Saturday sessions and use of the materials in the library was carefully recorded. These data were used to compare the effect of the treatment in the experimental group and the treatment in the control group upon the dependent variable motivation. Statistical analysis of data collected by this procedure is stated in Chapter IV.

Project Schedule

This project was held during the first three weeks of March, 1970. The experimental and the control groups were each given a total of nine 45-minute sessions. The time schedule for the sessions alternated each day with the experimental group meeting at 10:00 a.m. one day and at 11:00 a.m. the next day. The control group meeting at 11:00 a.m. one day, would meet at 10:00 a.m. the next day. This procedure was followed to help eliminate some of the contamination between the groups

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Eugene J. Webb, Donald T. Campbell, Richard D. Schwartz, Lee Sechrest, Unobtrusive Measures: Nonreactive Research in the Social Sciences (Chicago, Ill., Rand McNally and Co., 1966)

that undoubtedly occurs when both groups are taught in the same building. This alternating schedule and the separation of the "ALO" room from the "Traditional" room seemed to create no apparent unhappy feelings between the students in either group. The student and teacher cooperation during the project was excellent.

TIME SCHEDULE

DAYS	M	W	TH	T	W	F	M	W	F
10:00 A.M.	E	C	E	C	E	C	E	C	E
11:00 A.M.	C	E	C	E	C	E	C	E	C

ADDITIONAL SESSIONS

DAYS	SAT. I	SAT. II
9:00 A.M.	E	C
10:00 A.M.	C	E

Key: E = Experimental Group, C = Control Group

Selection of Control and Experimental Groups

A table of random numbers was used to randomize the total population of 46 students.⁴⁷ Each subject was assigned a different number from 1 through 46. A page and row of numbers was arbitrarily picked from the table of random numbers. The subject whose number corresponded with the first number on the table was placed in group A; the subject whose number corresponded with the second number on the table was placed in Group B; etc. until all the subjects were accounted for. A coin was flipped to determine which group was to be the experimental and which group was to be the control. With HEADS representing group A and TAILS representing group B, the coin was tossed and the side facing up was considered the experimental group.

This same procedure of randomization was used to select sub-groups A² and B² to be administered the achievement test in geometry prior to their respective treatments. In this case however, the total samples were 23 subjects.

Matching the Total Experimental and Total Control Groups

A statistical analysis of the collected data was made to verify how well matched the control and experimental groups were in terms of mental ages, chronological ages, knowledge of geometry, IQ, and attitude toward the arts prior to the treatment. The results of this analysis are presented in the following tables.

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E.F. Lindquist, Design and Analysis of Experiments in Psychology and Education (Houghton Mifflin Co.: Boston, Riverside Press, Cambridge, 1956), p. 385

TABLE 1
DATA FOR MATCHING CONTROL AND EXPERIMENTAL
GROUPS ON THE BASIS OF MENTAL AGE

GROUP	No.	MEAN	S.D.	S.E. _M ⁴⁸	S.E. _D ⁴⁹	Diff.	C.R.
		M.A.					
CONTROL	23	10.878	1.748	.364			
EXP.	23	10.760	1.273	.265	.264	.118	.446

Table 1 presents the statistical analysis of the data for matching the control and the experimental groups on the basis of mental age. The critical ratio of .446 shows that there is no statistically significant difference between the two groups.

TABLE 2
DATA FOR MATCHING CONTROL AND EXPERIMENTAL GROUPS
ON THE BASIS OF CHRONOLOGICAL AGE

GROUP	No.	MEAN	S.D.	S.E. _M	S.E. _D	Diff	C.R.
		C.A.					
CONTROL	23	9.887	.483	.100			
EXP.	23	9.927	.481	.100	1.707	.040	.023

Table 2 presents the statistical analysis of the data for matching the control and the experimental groups on the basis of chronological age. The critical ratio of .023 shows that there is no statistically significant difference between the two groups.

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John E. Freund, Modern Elementary Statistics (Third Edition) (Prentice-Hall, Inc., Englewood Cliffs, N.J., 1967), p. 209

49

Smith, op. cit., pp. 77-78

TABLE 3

DATA FOR MATCHING CONTROL AND EXPERIMENTAL GROUPS
ON THE BASIS OF ACHIEVEMENT IN GEOMETRY
(15 Item Test)

GROUP	No.	Mean R.S.	S.D.	S.E. _{M.}	S.E. _{D.}	Diff.	C.R.
CONTROL	11	8.909	2.507	.756			
EXP.	11	9.454	1.368	.412	.861	.545	.632

Table 3 presents the statistical analysis of the data for matching the control and the experimental groups on the basis of achievement in geometry as measured by the pre-test.

Five items from each part of the 45 item achievement test, making a total of 15 items, were administered to eleven subjects that were randomly selected within their own group.

Based upon the critical ratio of .632 and the randomization of the eleven subjects in each group, we can assume that the two groups were well matched in terms of knowledge of geometry before the treatment.

TABLE 4

DATA FOR MATCHING CONTROL AND EXPERIMENTAL
GROUPS ON THE BASIS OF IQ

GROUP	No.	MEAN R.S.	S.D.	S.E. _{M.}	S.E. _{D.}	Diff.	C.R.
CONTROL	23	108.391	17.735	3.698			
EXPER.	23	106.434	14.144	2.949	4.730	1.957	.413

Table 4 presents the statistical analysis of the data for matching the control and the experimental groups on the basis of IQ. The critical ratio of .413 shows that there is no statistically significant difference between the two groups.

TABLE 5

DATA FOR MATCHING CONTROL AND EXPERIMENTAL GROUPS
ON THE BASIS OF ATTITUDE TOWARD THE ARTS

GROUP	No.	MEAN ATT.	S.D.	S.E. _{M.}	S.E. _{D.}	Diff.	C.R.
CONTROL	23	11.521	3.894	.812			
EXPER.	23	11.478	4.247	.885	1.202	.043	.035

Table 5 presents the statistical analysis of the data for matching the control and the experimental groups on the basis of attitude toward geometry. The critical ratio of .035 shows that there is no statistically significant difference between the two groups.

Teaching Plans for the Experimental Group

The main objective of the teaching approach in the experimental treatment was to offer the student the opportunity to use the arts to create aesthetic experiences through which the learning of geometric concepts was mediated.

It was essential that the teacher of the experimental group understand the basic ingredients of the ALO environment in order to meet the objective as outlined.

The geometric concepts presented in the teachers manual (appendix) were taught in an informal atmosphere in which the teacher and students discussed ways of using the body, musical instruments, tape recorder, film slides, and any equipment or material available in the room to learn the geometric concepts and to communicate these concepts to others.

The teacher and students discussed and explored ways of using the body to make sounds that could represent the geometric figures and then how to transfer these sounds to body motion for reinforcement. Simple musical instruments and other objects in the room were also used to make sounds that represent the geometric figures. A rhythmic beat was chosen, the sounds and movements were selected, the form and length of each part was determined and a musical composition was born. The students and teacher then discussed and explored the possibility of using these same sounds and body motions in combination to make related geometric figures. An elastic tape was introduced to make triangles, squares, etc. by using the feet and arms to stretch the tape into the intended shape.

Knowledge of some of the teaching techniques used by exponents of

Creative Dance, Visual Arts, Creative Dramatics, Orff, Kodaly, Manhat-
tenville and Dalcrouz philosophies was an asset to the teacher of the
experimental group. It is the author's belief however, that the two
common elements found in all of the aforementioned philosophies, namely,
creativity and improvisation, are not beyond the capabilities of the
typical classroom teacher to establish in an ALO environment without
being artists, musicians, or dancers.

Behavioral objectives in terms of the learner can be stated as
follows:

1. The student will use his body to make geometric figures.
2. The student will use his body or materials in his sur-
roundings, or musical instruments to make sounds that
represent geometric figures in space.
3. The student will dramatize stories that he has written
about geometric figures that represent people or things
in his surroundings.
4. The student will indicate that he recognizes geometric
figures in his surroundings by using art materials to
describe them.
5. The student will work alone and/or in a group to create
different ways of using the arts to communicate geo-
metric concepts to others.

The design of the ALO room was meant to be conducive to both stu-
dent and teacher active participation and involvement in an aesthetic
learning atmosphere.

The room was equipped with the following items:

Rug - wall to wall

Large white paper - This was taped to walls and any other
space available.

Colored cut outs - Geometric shapes taped to walls.

Mobiles - Geometric mobiles hanging from ceiling.

Musical instruments - Simple tone bar instruments such as marimbas, metalephones, resonator bells, temple blocks, etc.

Sound makers - Any items found at home or school that make a sound.

Elastic Tape = 100" long with the ends tied together.

Colored marking pens - To draw on walls, etc.

Colored scarfs - Used in dance

Visual and Audio equipment - Slide projector and screen, Slides of people, things and buildings, tape recorder, and phonograph.

Colored paper and scissors - Used to cut geometric figures during the showing of slides.

Folding tables - Used to hold materials and make sounds.

Chalk board - Used by students and teacher to draw figures and write terms used in geometry.

There were no chairs or desks to hamper the students' movements during participation in the activities. A feeling of freedom of movement was important to the ALO atmosphere.

Teaching Plan for the Control Group

The control group was taught the same geometric concepts as the experimental group but in a typical traditional classroom atmosphere using the text-workbook written by the author. The statements and questions were discussed thoroughly and figures drawn on the chalkboard to reinforce the concepts. Where possible the geometric figures were related to objects in the room and personal experiences and activities outside the classroom.

Each student had a pencil, ruler, crayon and scissors to draw, cut or color figures in the workbook.

The teacher's manual for the control group, which includes the instructional objectives and text-workbook, is located in the appendix.

The Hawthorne Effect

In order to control for the Hawthorne effect, ten minutes of the control group sessions were devoted to watching slides of pictures that were in no way related to the lesson in geometry. The control group was told that the other group was not shown the same slides.

The Experimenter Bias

Because the experimental and control groups were taught by the same teacher, the author of this project, it was evident that the sincerity of this teacher to teach both groups with equal importance would be challenged. A teacher with a strong background in the arts might be biased toward the success of the experimental group. It was also evident that the teacher's lack of a strong mathematical background and ability to teach geometry in the traditional manner would be challenged. Given the fact, however, that this is a pilot study using a very small sample, adding another human personality to teach one of the groups at this stage would have introduced more unknown, uncontrollable variables. If and when this study is to be replicated it should be done with a larger sample, using more teachers.

The teacher's biases were considered very carefully before the research design was implemented. The objectives for each lesson plan were carefully selected and clearly stated. The time allotted for each daily assignment was carefully considered. The verbal reactions of the students to each lesson were recorded on tape at each session to reveal any changes in instruction that was needed to maintain the focus on the objectives as outlined. An observation of students' behaviors was made

by the teacher to determine possible changes in teaching approach or attitudes to maintain the focus on the objectives.

Limitations of the facilities, the time schedule for the project during the year, limited size of the population and length of the project were the main factors that could influence the results of this study.

These limitations, when considered in the light of an experimental investigation, could indicate not merely a negative influence on the resulting data but if the study showed a significant difference in the dependent variables in favor of the ALO, we could assume that this aesthetic approach to teaching would be successful under similar situations in other schools.

C H A P T E R I V

ANALYSIS AND INTERPRETATION OF DATA

The purpose of this chapter is to report the results of the analysis of the data and to interpret these findings in terms of the stated hypotheses and questions concerning the relationship among variables.

The data were analyzed in the following ways:

1. A comparative evaluation of gains in comprehension was made between the total experimental and the total control group. A "t" test was used to determine the significance of a difference between the means of two small independent samples.⁵⁰
2. A comparative evaluation of gains in retention was made between the total experimental and the total control group. A "t" test was used to determine the significance of a difference between the means of two small independent samples.⁵¹
3. A comparative evaluation of gains in motivation was made between the total experimental and the total control group. A chi-square test for two independent samples was used to determine the significance of a difference between the observed frequency of occurrences indicated by the unobtrusive measurement instruments.⁵²

⁵⁰ Milton Smith, A Simplified Guide to Statistics (Holt, Rinehart, Winston, Inc.: New York 1970) pp. 76-82

⁵¹ Ibid

⁵² Siegel, Sidney, Nonparametric Statistics for Behavioral Sciences (McGraw Hill Co. New York: 1956) pp. 107-109

In all cases the .05 level of confidence determined acceptance of an hypothesis.

- H 1. That the ALO method will produce a higher level of comprehension than the traditional method.

TABLE 6

DATA FOR DETERMINING DIFFERENCE BETWEEN MEANS
OF SCORES ON IMMEDIATE POST ACHIEVEMENT TEST

GROUP	No.	\bar{X}	Σx^2	SD	SE_D	t
CONTROL	23	32.565	1353.853	7.672	2.089	.374
EXP.	23	33.347	855.843	6.100		

This hypothesis was not generally supported by the data. The small difference between the means does however, indicate that the ALO was at least as effective as the traditional method in terms of comprehension.

- H 2. That the ALO method will produce a higher level of retention than the traditional method.

TABLE 7

DATA FOR DETERMINING DIFFERENCE BETWEEN MEANS
OF SCORES ON DELAYED ACHIEVEMENT TEST

GROUP	No.	\bar{X}	Σx^2	SD	SE_D	t
CONTROL	23	31.043	1926.937	9.153	2.413	.954
EXP.	23	33.347	1019.568	6.658		

This hypothesis was also not generally supported by the data, however the small difference between the means does indicate that the ALO method was perhaps slightly more effective than the traditional method

in terms of retention, though not significantly so.

- H 3. That the ALO method will produce a higher level of motivation than the traditional method.

This hypothesis was tested in two ways.

1. To compare the control group with the experimental group in terms of the number of students that used the materials in the library and also to compare the number of students that attended the Saturday morning sessions. The chi-square test for two independent samples with a 2 x 2 contingency table was used.⁵³
2. To compare the control group with the experimental group in terms of the total number of times the material was used in the library and the total number of times that students attended the Saturday morning sessions. A median test for two treatment groups with a chi-square test of independence in a 2 x 2 contingency table was used.⁵⁴

The data show that 21 students from the experimental group used the library material and 18 students from the control group used the library materials. That 13 students from the experimental group attended the additional sessions.

The obtained chi-square value of .673 for the library attendance and the chi-square value of 1.582 for the additional session attendance were not large enough to accept the hypothesis. (See appendix F page 1)

Students from the experimental group used the library materials a total of 147 times and the students from the control group used the library materials a total of 87 times. The obtained chi-square value of 1.715 from the median test was not sufficiently large enough to accept the hypothesis. (See appendix F page 10)

⁵³ Siegel, loc. cit.

⁵⁴ Siegel, op. cit., p. 208

Four students from the experimental group attended the additional sessions once and nine students attended twice. Eight students from the control group attended the additional sessions once and ten students attended twice.

Boy Scout meetings, baseball practice and scheduled out-of-town trips with parents offered stiff competition with the Saturday morning sessions.

Because there was a difference between the group of only one student attending the additional session twice, no test was used to determine the statistical significance.

Although a review of the combined results of the statistical analysis of the data indicates rejection of the hypothesis concerning motivation, further examination of the data reveals evidence which leads to the following statements:

1. The ALO method was as effective as the traditional method in terms of motivating students to use the materials in the library.
2. The ALO method did motivate certain students to use the material in the library more frequently than the traditional method.
3. The ALO method did motivate students to attend the Saturday morning sessions.
4. The ALO method did motivate nine students to attend the Saturday morning sessions more than once which is only one student less than the traditional method.

In view of the above statements it would seem that a complete rejection of this hypothesis would be incorrect.

The following is a report of the analysis of the data concerning the relationship between the attitude toward the arts and achievement, musical talent factors and achievement and personality traits

and Achievement. The Pearson Product Moment Correlation Formula was used in each analysis.⁵⁵

Attitude Toward the Arts and Achievement

The raw scores from the attitude test of both groups and the raw scores from the post achievement test of both groups were used to determine the relationship between attitude and achievement. The obtained correlation coefficient of $r = .073$ was not significantly different from zero to indicate a relationship between these variables.

Musical Talent Factors and Achievement

The raw scores from the Pitch test, Tonal Memory test and Rhythm test of both groups and the raw scores from the post achievement test of both groups were used to determine the relationship between musical talent and achievement. The obtained correlation coefficient of $r = .017$ was not significantly different from zero to indicate a relationship between rhythm and achievement. The obtained correlation coefficient of $r = .369$ was significantly different from zero at the $p > .05$ level of confidence which indicates a positive relationship between high scores on the tonal memory test and high scores on the achievement test. The obtained correlation coefficient of $r = .339$ was significantly different from zero at the $p > .05$ level of confidence which indicates a relationship between pitch discrimination and achievement. (See appendix F page 1)

Personality Traits and Achievement

Three factors of personality as determined by the I.P.A.T. test were considered in terms of their relationship to achievement.

1. Ego Weakness versus Ego Strength. (Factor C)
2. Super Ego Weakness versus Super Ego Strength. (Factor G)
3. Tough Minded versus Tender Minded. (Factor I)

The raw scores from factor C, G, and I tests of both groups and the raw scores from the post achievement test of both groups were used to determine the relationship between these personality factors and achievement.

The obtained correlation coefficient of $r = .352$ for factor C and achievement r was significantly different from zero at the $p > .05$ level of confidence to indicate a positive relationship between high ego weakness and high achievement.

The obtained correlation coefficient of $r = .145$ for factor G and achievement was not significantly different from zero to indicate a relationship between super ego and achievement.

The obtained correlation coefficient of $r = .104$ for factor I and achievement was not significantly different from zero to indicate a relationship between tough mindedness or tender mindedness and achievement.

Summary

The results of the analysis of the data concerning comprehension and retention did not indicate acceptance of the hypotheses on the basis of the selected $p = .05$ level of confidence. The small difference between the mean of the experimental and control groups in both cases does imply however, that the ALO method was as effective as, and perhaps slightly more effective than, the traditional method in terms of comprehension and retention of the geometric concepts presented.

The results of the analysis of the data concerning motivation did not indicate acceptance of the hypothesis on the basis of the selected $p = .05$ level of confidence. The small difference between the groups in terms of using the material in the library and attendance at the Saturday morning sessions implies however, that the ALO method was as effective as the traditional method in terms of motivating students to learn more about geometry.

The results of the analysis of the data concerning the relationship between Attitude and Achievement, Musical Talent and Achievement, and Personality Traits and Achievement are as follows:

1. There was no statistically significant relationship between attitude toward the arts and achievement.
2. There was no statistically significant relationship between aptitude in rhythm discrimination and achievement.
3. There was a statistically significant, positive relationship between high tonal memory and high achievement.
4. There was a positive relationship between high aptitude in pitch discrimination and high achievement.
5. There was no statistically significant relationship between tough mindedness or tender mindedness and achievement.

6. There was a statistically significant, positive relationship between high ego strength and high achievement.
7. There was no statistically significant relationship between super ego and achievement.

CHAPTER V

Summary

The role of the arts in education is a very controversial issue, especially in view of the recent trends toward the development of humanities programs. The problem suggests the need for basic inquiry into the nature of interdisciplinary characteristics of the subjects taught within the humanities curriculum and the value of the arts as media for creating aesthetic experiences in which intellectual, physical and emotional behaviors interact and reinforce learning.

A review of the literature indicates that the arts and other disciplines in the curriculum offer very similar, if not the same, intellectual challenges to the individual such as: perceiving, reacting, evaluating and conceptualizing. Furthermore, the arts have an additional important non-verbal aesthetic quality which deals with the nurturance of the affective or humanistic side of the student such as feeling, emotions, love, empathy, awareness, and fantasy. These six behaviors are important to the development of the individual's personality, creativity and intuition. The role of the arts in education then, is not a peripheral experience but an essential part of the core of the curriculum.

This present experimental investigation is an attempt to identify, construct, and evaluate an environment in which the arts are used to create aesthetic experiences designed to offer the opportunity for the integration of cognitive learning with affective learning. This environment was considered in terms of its possible practical value to the classroom teacher for reinforcing the learning of certain con-

The experimental group and the control group were taught selected geometric concepts as outlined for their respective groups. During this time the students were offered the opportunity to visit the library and investigate information related to the field of geometry. An immediate post test and a delayed post test were given to the total experimental and total control group after treatment. Data collected from these tests were used to examine the variables comprehension and retention.

The students in both groups were offered the opportunity to attend additional Saturday morning sessions. Data collected from the library visits and attendance at the additional sessions were used to examine the variable motivation.

Conclusions

The purpose of this study was to determine to what extent an Aesthetic Learning Opportunity (ALO), in which the arts are used to teach one aspect of an academic discipline, (Geometry) will effect changes in motivation, and comprehension and retention of information in selected groups of students.

The rejection of the hypotheses concerning comprehension and retention, based upon the results of the statistical analysis of the data presented in Chapter IV, would indicate that the ALO approach to teaching selected geometric concepts is not significantly better than the traditional approach. However, the data reveal a trend which indicates that the ALO method certainly was as effective and in some cases slightly more effective than the traditional method in terms of comprehension and retention of information.

Motivation was considered as a possible important side effect of any experience a student might encounter in the classroom. This experience, if pleasurable, might be expected to trigger the desires for additional, similar experiences. The results of this brief study did not reveal any statistical significance between the experimental and control groups in terms of motivation. However, based upon the statements made in Chapter IV concerning motivation and an examination of Table 8 in Appendix F Page 1 , there is reason to believe that a student can be motivated to want to learn more about geometry equally as well in an art media created aesthetic-environment as in a traditional classroom situation.

Pitch discrimination and tonal memory were found to be significantly related to comprehension and retention of geometric concepts. This information can be considered useful only as an indication that a student's aptitude in pitch and tonal memory is correlated with his ability to comprehend and retain geometric concepts.

An examination of charts I and II in Appendix F reveals that certain students in the experimental group with scores below the means of the pitch discrimination and tonal memory test made higher scores on the immediate and delayed achievement tests than students with similar scores in the control group. This is a significant indication that certain students with low aptitude in these variables tend to make greater gains in achievement in an ALO environment than in a traditional environment. (See Tables 9 and 10, Appendix F Page 1). It is not known why this situation exists, however we may surmise that an experience such as the ALO awakens the individual's capacities in pitch

discrimination and tonal memory and enables these capacities to be devoted to the comprehension of information. This is an area that deserves further investigation.

Although the statistical analysis of the data did not indicate a significant relationship between attitude toward the arts and achievement, an examination of charts III and IV in Appendix F reveals the following information:

1. Out of ten students in the control group with attitude scores below the mean, five obtained a score above the mean on the delayed post achievement test.
2. Out of eleven students in the experimental group with attitude scores below the mean, nine obtained a score above the mean on the delayed post achievement test.

In view of the above statement we may surmise that certain students with a poor attitude toward the arts will make greater gains in retention of information presented in an ALO environment than in a traditional environment.

In my judgement, it is difficult to separate personality factors regardless of the reliability and validity of the personality test used for this purpose. However, even in a short study such as this one, personality characteristics could effect changes in learning behaviors such as comprehension and retention under certain environmental conditions. Any indication that a student who has ego weakness tendencies, super ego weakness tendencies, or maintains a strong minded attitude will make greater gains in achievement in an ALO environment than in the traditional environment could be considered a valuable feature of the ALO. This feature would also suggest further investigation of the ALO environment in terms of other personality characteristics.

A review of the results of the analysis of the data and an examination of charts V and VI in Appendix F reveals the following information:

Out of eight students in the control group found to have ego weaknesses, four obtained scores above the means on the delayed post test for achievement and three obtained scores on the delayed test that were higher than their scores on the immediate achievement test.

Out of seven students in the experimental group found to have ego weaknesses, four obtained scores above the means on the delayed post test for achievement and four obtained scores on the delayed test that were higher than their scores on the immediate achievement test.

In view of the above statements, we may surmise that students with emotionally unstable tendencies will make greater gains in retention of information presented in an ALO environment than in a traditional environment.

Out of eight students in the control group found to have super ego weaknesses, four obtained scores above the mean on the delayed post test for achievement.

Out of sixteen students in the control group found to have super ego weaknesses, twelve obtained scores above the mean on the delayed post test for achievement.

In view of the above statements we can conclude that students having super ego weaknesses will make greater gains in retention of information presented in an ALO environment than in a traditional environment.

Out of eight students in the control group having tough minded tendencies, one obtained a score on the delayed post test for achieve-

ment that was higher than his score on the immediate post test.

Out of fourteen students in the experimental group having tough minded tendencies, eight obtained scores on the delayed post test for achievement that were higher than their scores on the immediate post test.

In view of the above statements we can conclude that students with tough minded tendencies will make greater gains in retention of information presented in an ALO environment than in a traditional environment.

Limitations of the Study

Although excellent cooperation was received from the principal and teachers of the Wheelock Elementary School, scheduling problems and availability of room facilities limited the length of time for teaching sessions to three weeks. Regardless of this time element, however, the results of a subjective and statistical analysis of the data indicate that students did learn and in some cases were motivated to want more of the same kind of experience.

The size of the sample for the project was limited to the total enrollment of the fourth grade at Wheelock School. A larger sample would have given more "weight" to the results of the statistical analysis of the data but would have demanded larger rooms for instruction, and the bussing of fourth grade students from a different area of the city.

A statistical analysis of a relationship among variables such as attitude toward the arts, personality factors, musical talent and intelligence, was seriously considered as a valuable part of this study. In my opinion, however, an extension of this study, with a larger sample

of subjects and a longer period of time for more sessions, is needed before such an analysis would show convincing, significant results.

Implications for Future Research

This study considered the correlation of certain personality factors, attitude and musical talents with comprehension and retention of information. Similar research into this area should perhaps be undertaken on a larger scale using a greater number of subjects. A statistical analysis of all of the data collected from tests concerning these independent variables could reveal more clearly defined evidence of the interaction of certain human characteristics with the ALO environment.

The results of this study indicate that it is possible to teach geometric concepts to children using the ALO method. Further research is needed to determine if the ALO method can be used to teach concepts in other disciplines.

The Special Education Programs in the public schools rely upon the perceptual efficiency of children to help them solve problems of learning. Data from this investigation suggests that the ALO method, because of its potential for presenting stimuli that appeal to so many sense modalities, would be a valuable asset to special education curricula. Future research in this area might be directed toward the effect of the ALO method on a specific perceptual dysfunction.

One of the most gratifying outcomes of this study was the favorable reaction of the elementary classroom teachers to the ALO approach to teaching. Using movement, sound, art and dramatics as media to interpret concepts in subjects such as science, added a different dimension to the usual classroom experiences. Children, they said, found it difficult to grasp the objective of the ALO, but soon settled down

and became thoroughly involved.

An extension of this study then, would be to investigate the feasibility of developing public school curricula based upon the rationale of the ALO and its implementation.

In the event that this study is replicated some attention should be given to unanticipated positive results of the ALO method. These results are in the form of a freer, happier, more responsive, creative individual. This is certainly a more humanistic kind of side effect than is offered by the typical educational approach to teaching that punishes creativity.

In the ALO method children are encouraged to open their minds and explore possible connections between the arts and other subjects without meeting the traditional demand for prerequisites within a subject area before relationships with subjects outside this area are considered. The positive relationship of the arts to the learning of geometry, shown by this study, indicates that relating the arts to other subjects offers a more creative lateral transfer of learning than the traditional vertical transfer of learning found in educational institutions. Skinner refers to transfer of learning as being "concerned with the question of whether or not the learning of material A - say mathematics - aids, hinders, or does not affect the subsequent learning of material B - say, physics or chemistry. This theory assumes nothing about faculties of the mind, but is concerned with how the organism meets situations B, C, D, and so forth, after having had an experience in situation A. Educationally, it is concerned with finding out how the organism can benefit to the largest degree from its experience in

situation A when it finds itself face to face with situations B, C, D, and so forth."⁵⁷ Because it takes time for teachers and students to become totally involved in a learning environment that is conducive to creative lateral transfer, a longitudinal study is needed to investigate and evaluate the ALO method.

The ALO approach to teaching is similar to other intrinsic, educational techniques such as the linguistic approach to teaching reading and the linguistic, structural approach to language. These techniques ask children to solve given problems in a way that leads to divergent thinking. This similarity suggests further inquiry into the possible marriage of these divergent, educational techniques.

A teacher education program developed from this study would include the teaching of the basic principle of interrelationships, which in this case involves the properties of things, the identification of subject matter to be used, and a clarification of teaching skills needed to meet the requirements for reaching the basic objective of the ALO method in different populations. The development of such a program would be the outcome of further investigation of this study.

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Skinner, op. cit. Third edition, p. 524

APPENDIX A

TEACHER'S MANUAL
for
EXPERIMENTAL PROJECT

CONTROL GROUP

INTRODUCTION

The students in the control group are to be taught geometry in the traditional manner and in an elementary classroom with chairs and desks, using the text-workbook given to them before each session. Statements and questions are to be discussed thoroughly and geometric figures drawn on the chalkboard or on an overhead projector if the teacher wishes. When possible, the geometric figures are to be related to objects in the room and personal experiences outside the classroom. Each student needs a pencil, ruler, crayon, and scissors, to draw, cut or color figures in the workbook.

Each forty-five minute session is to begin with a ten minute presentation of colored slides or a movie that does not refer to geometry. The remaining thirty-five minutes is used to teach the lessons outlined in the teacher's manual that correspond to the instructions in the student's text-workbook.

If there is time left over after completing the lesson plan for each session, the students are not to continue on to the next lesson. If however, the lesson plan is not completed within the allotted time for a session, it can be completed at the next session.

Read the directions to the exercises in the student's text

with the children and remind them to be guided by the pictures as they draw. Be sure the directions are followed accurately, but give everyone a chance to think through them.

Allow time for the children to work each exercise, and then guide a discussion of it elaborating on the ideas they present.

LESSON I

Exercises 1-7

Objectives

To help children relate objects of the physical world to objects that we think about in the world of geometry.

To introduce points, lines, line segments and rays as basic figures of geometry

To show that the angle and triangle are made up of basic geometric figures.

Vocabulary

Geometry
Point
Figure

Line Segment
Line
Triangle

Ray
Angle

Materials

Ruler, pencil and unlined paper for each student.

Instructional Directions

Call attention to the four basic figures at the top of the student's text and discuss them in terms of objects in the classroom.

Draw several examples of lines, rays and segments on the chalkboard using a straight edge. then help the children with their exercises in the workbook.

LESSON II

Exercises 8-12

Objectives

To introduce the concept of segments being longer, shorter or the same length.

To introduce the notation (symbols) for line segments.
($AB \cong CD$)

To relate the concept of congruency to the physical world of students.

Vocabulary

Congruent
Not Congruent
Same

Notation
Longer

Symbol
Shorter

Material

Text
Pencil
Ruler

Instructional Directions

Draw several line segments of different lengths on the chalkboard. Using the symbols A,B,C,D, etc.. Discuss these lines as not congruent and relate this concept to line segments in the design of the classroom.

Draw several line segments of the length using the notation A,B,C,D, etc.. Discuss these lines as congruent and relate this concept to the design of the classroom.

Have the children read the text for Lesson II and follow the directions.

Be sure to use the symbols that represent the notations for line segments.

Example:

Segment A B is congruent to segment C D. Written $AB \cong CD$. Demonstrate several examples of notating congruent line segments on the chalkboard.

Segment A B is not congruent to segment C D. Written $AB \not\cong CD$.

LESSON III

Exercises 13-16

Objectives

To introduce the concept that two line segments drawn from a common point make an angle.

To introduce the concept of congruent and not congruent angles.

To relate the concept of congruent and not congruent angles to the physical world of the students (classroom)

To introduce the notation for angles.

Vocabulary

Common point $\angle ABC \cong \angle CDE$

Material

Text
Pencil
Ruler

Instructional Directions

Draw several angles of different sizes on the chalkboard using the symbols ABC, DEF, etc.. Discuss these angles as not congruent or congruent and then relate this concept to objects in the classroom.

Draw several angles of the same size and discuss them as congruent; notating them as such.

Example:

$\angle ABC \cong \angle DEF$ etc..

Relate this concept to the figures in the classroom

Have the children read Lesson III and follow the directions.

Be sure to discuss the symbols and notation for the angles

LESSON IV

Exercises 17-21

Objectives

To introduce the triangle as a geometric figure having three congruent or not congruent sides and angles.

To introduce the equallateral and isosceles triangle as Geometric Figures.

Vocabulary

Equallateral

Isosceles

Material

Text
Pencil
Ruler

Instructional Directions

Draw several triangles of different shapes and sizes on the chalkboard. Call attention to the three angles and three sides.

Draw an equallateral and an isosceles triangle on the chalkboard. Call attention to special design of these triangles such as congruent sides and angles.

LESSON V

Exercise 22-24

Objectives

To introduce the quadrilateral as a geometric figure having four congruent or not congruent sides and angles.

To introduce the square and rectangle as quadrilateral Geometric Figures.

Vocabulary

Quadrilateral
Square
Rectangle

Material

Text
Pencil
Ruler

Instructional Directions

Draw several quadrilaterals of different shapes and sizes on the chalkboard. Call attention to the four sides and four angles.

Examples:

Draw the square and rectangle on the chalkboard and call attention to the congruent sides and angles.



LESSON VI

Exercises 25-27

Objectives

To introduce the pentagon as a geometric figure having five congruent or not congruent sides and angles.

To relate the geometric figures presented in Lesson I II III IV V and VI, to the physical world in and outside the classroom (trees, houses, cars, trucks, corners of the room, windows, etc..).

Vocabulary

Pentagon

Review (Review of vocabulary in previous lessons).

Material

Text

Pencil

Ruler

Instructional Directions

Draw several pentagons on the chalkboard of different shapes and sizes. Call attention to the five sides and five angles.

Example:



Draw a pentagon with congruent sides and angles and call attention to the congruency of the figure.

Example:



Discuss the different designs of the geometric figures presented in all lessons using the vocabulary to help review.

LESSON VII

Exercises 28-29

Objectives

To introduce the polygon as a geometric figure having unequal sides and unequal angles.

To relate the polygon to the physical world inside and outside the classroom.

To compare the polygon with other geometric figures presented in the student text.

Vocabulary

Polygon

Review of vocabulary in previous lessons.

Material

Text

Pencil

Ruler

Instructional Directions

Draw several polygons on the chalkboard of different shapes and sizes, Call attention to the unequal sides and unequal angles.

Example:



Discuss the difference between figures with equal sides and angles with figures with unequal sides and angles. Use figures presented in previous lessons.

LESSON VIII

Exercises 30-33

Objectives

To introduce parallel lines as geometric figures that extend in the same direction and always maintaining the same distance from each other. (equidistant)

To relate parallel lines to the construction of figures such as, polygons, quadrilaterals, pentagons, etc..

To compare figures with parallel lines to figures without parallel lines.

Vocabulary

Parallel Lines
Equidistant

Material

Text
Pencil
Ruler

Instructional Directions

Discuss the definition of parallel lines and call attention to the figures in exercise #30, and #31.

Example:

Figure I \overline{AB} parallel to \overline{CD}

Discuss the parallel lines found in the classroom and outside the classroom.

LESSON IX

Exercises 34-36

Objectives

To introduce ways of making parallel lines by using a ruler, pencil, paper, and scissors.

To introduce the parallelogram as a quadrilateral with opposite sides that are parallel and equal.

Vocabulary

Parallelogram
Intersecting Lines

Material

Paper
Pencil
Crayon (any color)
Scissors
Ruler

Instructional Directions

Draw parallel lines on the chalkboard using a yard stick as explained in exercise #34 in the text.

Read #35, 36, and 37 in the text with the students and do the exercises with them.

Discuss the results of these exercises in terms of the objectives.

Example:



Are these figures parallelograms?

Why?

APPENDIX B

TEACHER'S MANUAL
for
EXPERIMENTAL PROJECT
EXPERIMENTAL GROUP

INTRODUCTION

The main objective of the experimental treatment of this study is to offer the student the opportunity to use the arts to create aesthetic experiences through which the learning of geometric concepts are mediated. Knowledge of some of the teaching techniques used by exponents of Creative Dance, Visual Arts, Creative Dramatics, Orff, Kodaly, Manhattenville and Dalcrouz philosophies are an asset to the teacher of the experimental group. It is the author's belief however, that the two common elements found in all of the aforementioned philosophies, namely creativity and improvisation, are not beyond the capabilities of the classroom teacher to establish in an AIO environment without being an artist, musician or dancer. The role of the teacher is to present each geometric lesson to the students by directing and suggesting certain activities that free the student from perceiving the geometric concepts within the limits of written or verbal description. The students do not use a text or workbook, therefore the teacher must present the lessons by other means of communication such as, writing on the papered walls, chalkboard, or poster board and using a tape recorder or film slides.

Each lesson in the manual is to be taught in an informal manner in which the teacher and students discuss and explore ways of using the voice, body, musical instruments, art materials, dramatic presentation, or movement, singly or in combination, to interpret the geometric concepts and to communicate these interpretations to others. The geometry lessons for the experimental group correspond to the lessons outlined for the control group. The objectives however, are stated in behavioral terms of the learner which are meant to be used as guides for activities initiated by the student and teacher. Instructional procedures are not written for each lesson because it is the purpose of the ALO method to offer the opportunity for students and teachers to develop their own learning experiences. Each group has its own unique behavioral characteristics and may reach the goal of understanding the information presented through a different learning process than other groups.

The following objectives are examples of the expected behaviors of students in the experimental group.

1. The student will use his body to make geometric figures.
2. The student will use his body or materials in his surroundings, or musical instruments to make sounds that represent geometric figures in space.
3. The student will dramatize stories that he has written about geometric figures that represent people or things in his surroundings.

4. The student will indicate that he recognizes geometric figures in his surroundings by using art materials to describe them.
5. The student will work alone and/or in a group to create different ways of using the arts to communicate geometric concepts to others.

The forty-five minute sessions must begin with five minutes for children to investigate the room and its contents. The remaining forty minutes are to be used to teach the lesson in geometry. It is not necessary to adhere strictly to the lesson plans as outlined for each session. If the lesson is completed before the class period ends, the next lesson may be started. If the lesson is not completed before the class period ends, the lesson is to be continued at the next session.

The AIO room should be equipped with the following items:

Rug - wall to wall

Large white paper - This is taped to walls and any other space available.

Colored cut outs - Geometric shapes taped to walls.

Mobiles - Geometric mobiles made by students and teacher hanging from the ceiling.

Musical instruments - Simple tone bar instruments such as marimbas, metallophones, resonator bells temple blocks and rhythm band instruments.

Sound makers - Any items found at home or school that make a sound.

Elastic Tape - 100" with the ends tied together.

Colored marking pens - To draw on walls, etc..

Colored scarfs - Used in dance.

Colored paper and scissors - Used to cut geometric shapes.

Visual and Audio equipment - Slide projector and screen, Slides of people, things and buildings, tape recorder and phonograph.

Folding tables - Used to hold equipment and make sounds.

Chalk board - Used by students and teacher to draw figures and write terms used in geometry.

There should be no chairs or desks in the ALO room to hamper the students' movements during the participation in activities. A feeling of freedom of movement is important to the ALO atmosphere.

LESSON I

Exercise 1-7

Objectives

The student will use body movement combined with vocal sounds to represent the geometric figures listed in the vocabulary for this lesson.

The student will use simple musical instruments or materials in the room to make sounds that represent the geometric figures listed in the vocabulary in this lesson.

Given an elastic tape-band, the student will make a line segment, ray, angle and triangle using his arms and legs.

The student will identify the geometric figures that are drawn on the walls and ceiling of the room by repeating the sounds and body movements they have chosen.

Vocabulary

Geometry
Point
Line Segment

Line
Triangle
Ray

Angle
Figure

Materials

Simple musical instruments

- a. Xylophones (Glockenspiels, Metalophones, Marimbas.)
- b. Rhythm Band instruments. (Triangles, Cymbals, Claves, Woodblocks, Rattles, Castanets.)
- c. Drums

Poster board, and paper with geometric figures drawn on them. These items are taped to the walls and ceiling of the room.

Elastic Tape-band aprox. 100" in circumference.

Instructional Directions

Discuss point, line, ray and segment as geometric figures in space. Refer to the drawings on the walls, the shape of the room and things the children see in their every day life.

Discuss and explore ways of using sound and body movement to represent the concept of point, line, ray and segment and then transfer these examples to the instruments and material in the room.

Consider each of the above terms within the rhythmic pattern of three pulses. RAY = $\text{♩} \cdot$, LINE = $\text{♩} \cdot$, POINT = $\text{♩} \text{♩} \text{♩}$, SEGMENT = $\text{♩} \text{♩} \cdot$. The students repeat each term twice maintaining the feeling of three pulses and using the body movements and vocal sounds. Some students can use the instruments to achieve the same results.

The class can be divided into two or three small groups with each group entering after the others begin. This rhythmic composition is now a round.

The elastic tape is used to make segments, rays and angles and then referred to as parts of a triangle. Different shapes of angles and triangles are demonstrated by the teacher and the students with the tape. The demonstrations can be used in conjunction with the rhythmic composition made by the students.

Example:

POINT - Slap the knees with the hands once, clap the hands once and snap the fingers of one hand at the same time pointing into space. Say the word "point" with each motion in a slow rhythm of three pulses.

LINE - Holding the right arm extended with the palm of the hand down, bring the hand across the body in a straight line to the right. As the arm is traveling from left to right, say "line". Do the same with the left arm and hand going left. The word "line" should continue through three pulses.

RAY - Hold the right arm in from of the body making a fist with your hand. As you say the word "ray", the fist punches the air, the arm moves to the right as the hand opens and the arm makes a motion into space.

SEGMENT - With both hands made into a fist and held close together in front of the body, the word "segment" is said as the fists are separated in a rhythmic motion of three pulses.

LESSON II

Exercises 8 - 12

Objectives

Given the concept of segments being longer or shorter or the same length, the student will demonstrate that he understands the concept by using vocal sounds and body movement.

Shown two xylophone bars of equal length and two xylophone bars of unequal length, the student will demonstrate that he can discriminate between lengths of segments by hitting the tone bars with a mallet.

The student will demonstrate that he recognizes the difference in pitch of the tone bar-segments by making a high pitch vocal sound with the short tone bar and a low pitch vocal sound with the long tone bar.

The student will use body movement and vocal sounds to represent the symbols for congruent (\cong) and not congruent (\ncong).

Vocabulary

Congruent
Not congruent
Same

Notation
Longer

Symbol
Shorter

Material

Xylophone with removable bars.

Flash cards with symbols for congruent and not congruent.

(These symbols could be drawn or taped to the walls.)

Instructional Directions

Draw different lengths of line segments on the chalkboard and refer to each one as being longer than, shorter than or the same length as the others. As you point to each segment, make a vocal sound that corresponds to its length. Let each student make a vocal sound that corresponds to the length of a segment as he sees it. Suggest that the sound for a short segment be higher than the sound for a long segment. Demonstrate that high pitched tone bars are short segments and that low pitched tone bars are long segments. Let the student explore the sounds of instruments and objects in the room that can represent different lengths of segments.

Introduce the symbol for congruent and not congruent. (\cong), (\ncong). Suggest vocal sounds and body movements that could be used to represent these symbols.

LESSON III


Exercises 13-16

Objectives

Given the concept that two line segments drawn from a common point make an angle, the student will demonstrate that he understanding this concept by using the elastic tape-band or his body.

The student will demonstrate that he understands that angles are congruent or not congruent to other angles by using the vocal sounds already chosen for congruency in lesson II.

Using any material in the room such as bars from the xylophones, yard sticks, elastic tape-band, marking pens to draw on the paperd walls, the body, etc., the student will make several different sized angles and use letter names for each point of the angle segments.

The student will demonstrate that he understands the visual notation for angle given to him by the teacher, by using rhythm instruments or body sounds as the media for interpreting the rhythmic patterns of the notation. Example: " ANGLE A B C " =


Vocabulary

Common point
 ABC CDE

Materials

Xylophone with removable bars.
 Elastic tape-band.
 Yard sticks.

Marking pens.
 Cards with letters of
 the alphabet.

The behavioral objectives as stated, can be used as a guide to the teacher for determining strategies for teaching this lesson.

LESSON IV

Exercises 17-21

Objectives

Given the definition of a triangle as having three congruent or not congruent sides and angles, the student will demonstrate that he understands this concept by using material in the room, body movement or body sounds.

Given the definition of an equallateral triangle as having three congruent sides and angles and the definition of an isosceles triangle as having two long congruent sides and angles and one side and angle that is not congruent to the other two angles and sides, the student will make these triangles using material in the room, body movement or body sounds. (Xylophone bars, singing etc..)

The student will explore other geometric figures he knows using the same procedure outlined in the above objective.

Vocabulary

Equallateral

Isosceles

Material

Any material available in the room or brought to school by the student.

Instructional Directions

Using the concept presented in lesson II that long tone bars from the xylophone (segments) produce a low pitch and that short tone bars produce a high pitch, play three tone bars that have the same pitch. Relate these three pitches to the equilateral triangle.

Using the same procedure as described above, play two low pitched tone bars and one high pitched tone bar. Relate these sounds to the isosceles triangle.

Offer suggestions to the students how triangles can be represented by playing musical instruments, using the voice, or using sounds made by hitting chairs, tables etc..(Sing triangles.)

A musical composition can be created by the students and teacher by using the combination of sound, movement, and visual aids.

Example:

Introduction - Xylophones with bars arranged in the pentatonic scale, (Do-Re-Mi-Sol-La). Several students play any combination of pitches in a rhythmic pattern of three pulses, very slowly. ♩ ♩ ♩ or ♩ ♩ ♩.

Part A - Students using colored scarfs, moving in a circle or around other students, sing the following song:

S M L | S M L | S M L | S . | S M L | S M |
 ♩ ♩ ♩ | ♩ ♩ ♩ | ♩ ♩ ♩ | ♩ . | ♩ ♩ ♩ | ♩ ♩ |
 I am a triangle what is my name? Three sides and angles,
 S M R D | | Repeat at least twice.
 ♩ ♩ ♩ | ♩ . ||
 that is the game.

Part B - Students make equilateral and isosceles triangles with their body or elastic tape-band and chant the word of the song while other students maintain the beat with hand clapping and playing the xylophones and other instruments.

Part A - Same

Coda - Keeping the tempo and rhythm of the composition constant, the students repeat the words "equilateral (♩ ♩ ♩) and isosceles, (♩ ♩ ♩) as the sounds get softer and softer then die away.

LESSON V

Exercises 22-24

Objectives

Given the definition of quadrilateral as a geometric figure having four congruent or not congruent sides and angles, the student will use art materials, movement, music or dramatics to communicate this concept to other students in the class.

Vocabulary

Quadrilateral
Square
Rectangle

Material

Any material available in the room or brought to school by students or the teacher.

Instructional Directions

The student and teacher investigate ways of communicating the given concept of quadrilateral figures, using the arts as the medium.

Example:

The student may write a short play, using the quadrilateral and other geometric figures to represent personalities and then present the play to the class.

LESSON VI

Exercises 25-27

Objectives

Given the definition of a pentagon as a geometric figure having five congruent or not congruent sides and angles, the student will use art materials, movement, music or dramatics to communicate this concept to other students in the class.

The students will compose a dramatization that includes geometric figures, discussed in previous lessons, to represent persons, places or things, using a familiar social problem as the theme.

Vocabulary

Pentagon

Review of vocabulary.

Material

Any material available in the room or brought to school by students or the teacher.

Instructional Directions

Divide the class into small groups to plan strategies for achieving the objectives as stated. Talk with each group and ask questions that will guide them in the direction of a successful presentation based upon their decisions.

LESSON VII

Exercises 28-29

Objectives

Given the definition of polygon as a geometric figure having unequal sides and unequal angles, the student will use art material, music, movement or dramatics to demonstrate that he understands this concept.

The student will identify geometric figures in pictures of buildings by using sound as the medium to describe them.

Vocabulary

Polygon

Review of vocabulary.

Material

Film strips or film slides of buildings.

Film projector and screen.

Colored paper and scissors.

Instructional Directions

Divide the class into small groups to plan strategies for achieving the objectives as stated. Talk with each group and ask questions that will guide them in the direction of a successful presentation based upon their decisions.

The students may use colored paper and scissors to cut out geometric figures they see in the pictures shown them on the screen.

LESSON VIII

Exercises 30-33

Objectives

The student will demonstrate that he understands that parallel lines are geometric figures that extend in the same direction and always maintain the same distance from each other, (Equidistant) by using body movement, art material or sound.

The student will identify parallel lines in the construction of geometric figures such as, polygons, quadrilaterals, pentagons, etc., by using the communicative methods discovered in earlier lessons.

The student will identify parallel lines in pictures of city and country scenes by using a pointer to point them out and at the same time using a vocal sound that represents parallel lines.

Vocabulary

Parallel
Equidistant
Review of vocabulary

Material

Film strip or film slides of city and country scenes.
Film projector and screen.
Art materials

Instructional Directions

Using two or more yard sticks, the teacher demonstrates the concept of parallel lines. The word "equidistant" is introduced in reference to parallel lines and lines that are not parallel.

The words "parallel" and "equidistant" can be used in a rhythmic pattern in a musical composition similar to the one in lesson IV.

LESSON IX

Exercises 34-36

Objectives

Given the definition of parallelogram as a quadrilateral with opposite sides that are parallel and equal, the student will use his previous experiences in the former lessons to indicate that he understands this concept.

Vocabulary

Parallelogram
Review of vocabulary

Material

Any material available in the room or brought to school by the student or teacher.

Instructional Directions

The teacher and students discuss the definition of parallelogram and how previous experiences with the quadrilateral in former lessons could apply to this geometric figure.

Techniques used in former lessons could be used here, such as a short dramatization of a written play using the parallelogram as the main character, a musical composition using the words "parallelogram" and "quadrilateral" in a rhythmic pattern of four pulses (♩ ♪ ♪ ♩), or drawing or making a figure that contains several or all geometric concepts.

APPENDIX C

ATTITUDE
QUESTIONNAIRE

NAME _____ AGE _____

SCHOOL _____ GRADE _____

DATE _____

ATTITUDE QUESTIONNAIRE

PART I

THE PURPOSE OF THIS QUESTIONNAIRE IS TO FIND OUT WHAT YOU THINK ABOUT CERTAIN OBJECTS AND ACTIVITIES IN YOUR SURROUNDINGS.

READ EACH QUESTION CAREFULLY AND THEN PLACE AN X IN THE SQUARE TO THE RIGHT OF THE OBJECT OR ACTIVITY YOU WOULD LIKE THE BEST. THERE ARE NO RIGHT OR WRONG ANSWERS BUT YOU MUST MAKE A CHOICE AND MARK AN X IN ONE OF THE SQUARES.

WHICH OF THE FOLLOWING ITEMS OR ACTIVITIES WOULD YOU LIKE THE BEST?

- | | | |
|----|--|--------------------------|
| 1. | PAINT SET _____ | <input type="checkbox"/> |
| | OR | |
| | A GAME PLAYED WITH PLASTIC SQUARES, TRIANGLES AND CIRCLES. _____ | <input type="checkbox"/> |
| 2. | BLOCK PUZZLE _____ | <input type="checkbox"/> |
| | OR | |
| | PICTURE PUZZLE _____ | <input type="checkbox"/> |
| 3. | PUPPET SHOW THEATRE SET _____ | <input type="checkbox"/> |
| | OR | |
| | DRAWING BOARD WITH TOOLS FOR DRAWING HOUSES _____ | <input type="checkbox"/> |
| 4. | MODEL KIT OF A HOUSE _____ | <input type="checkbox"/> |
| | OR | |
| | MODEL KIT OF A FLOWER _____ | <input type="checkbox"/> |

5. VERY LARGE CARDBOARD BOX _____ ☐
- OR
- RECORD OF DANCE MUSIC _____ ☐
6. MUSICAL INSTRUMENT _____ ☐
- OR
- MATERIALS AND TOOLS TO MAKE SMALL PLAY HOUSE _____ ☐
7. COLORED PICTURES OF THE BEAUTIFUL SCENERY
IN DIFFERENT PARTS OF AMERICA _____ ☐
- OR
- WOOD LOG BUILDING SET _____ ☐
8. PLAY A GAME OF CHECKERS _____ ☐
- OR
- PAINT A PICTURE OF SNOW TOPPED MOUNTAIN _____ ☐
9. TOY BRICK SET FOR BUILDING HOUSES _____ ☐
- OR
- TAP DANCING SHOES _____ ☐
10. A MUSIC BOOK _____ ☐
- OR
- A GEOMETRY BOOK _____ ☐

11. A PART IN A SCHOOL PLAY _____ ☐
- OR
- A KIT FOR MAKING A MODEL AIRPLANE _____ ☐
12. WRITING A PLAY FOR THE CLASS _____ ☐
- OR
- MAKING UP MATHEMATICAL PROBLEMS FOR THE CLASS
TO SOLVE _____ ☐
13. WAVING YOUR ARMS OR CLAPPING YOUR HANDS, OR MOVING
YOUR BODY TO MUSIC _____ ☐
- OR
- DRAWING SQUARES AND OTHER GEOMETRIC FIGURES ON PAPER _____ ☐
14. DANCING TO MUSIC _____ ☐
- OR
- BUILDING A BIRD HOUSE _____ ☐
15. A GAME THAT USES PLAYING CARDS WITH NUMBERS _____ ☐
- OR
- SEVERAL SHEETS OF COLORED PAPER TO BE CUT OUT
AND PASTED ON POSTERBOARD ANY WAY YOU WISH _____ ☐
16. PRETEND YOU ARE BUGS BUNNY _____ ☐
- OR
- PLAY HOP SCOTCH _____ ☐

17. SING _____ ☐
- OR
- DRAW TRIANGLES, SQUARES, CIRCLES, AND OTHER
GEOMETRIC FIGURES _____ ☐
18. CUT TRIANGLES, SQUARES, AND CIRCLES, FROM A
PIECE OF WOOD _____ ☐
- OR
- SING SONGS IN SCHOOL _____ ☐
19. MAKE ANIMALS OUR OF CLAY _____ ☐
- OR
- MAKE GEOMETRIC FIGURES, SUCH AS; CUBES, PYRAMIDS
OUT OF CLAY _____ ☐
20. WATCHING DANCING ON T. V. _____ ☐
- OR
- LOOKING AT PICTURES OF FAMOUS CHURCHES _____ ☐

APPENDIX D

ACHIEVEMENT TEST

NAME _____ AGE _____

SCHOOL _____ GRADE _____

DATE _____ GROUP _____

MULTIPLE CHOICE

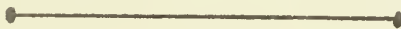
DIRECTIONS: DRAW A CIRCLE AROUND THE ANSWER THAT BEST DESCRIBES EACH GEOMETRIC FIGURE.

EXAMPLE:



DOT
POINT
SIDE
SEGMENT

1.



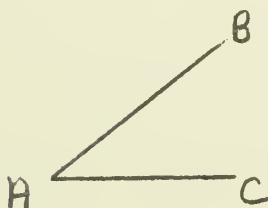
LINE
RAY
POINT
SEGMENT

2.



RAY
AB
SEGMENT
ANGLE

3.



TRIANGLE
 \angle BAC
ANGLE CDE
SEGMENT

4.



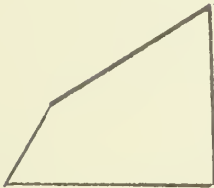
PENTAGON

ANGLE

TRIANGLE

SQUARE

5.



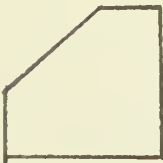
SQUARE

QUADRILATERAL

TRIANGLE

RECTANGLE

6.



QUADRILATERAL

HEXAGON

PENTAGON

POLYGON

7.



POLYGON

OCTAGON

HEXAGON

PENTAGON

8.



RAYS

SEGMENTS

PARALLEL LINES

POINTS

9.



SQUARE

HEXAGON

PARALLELOGRAM

PENTAGON

10.



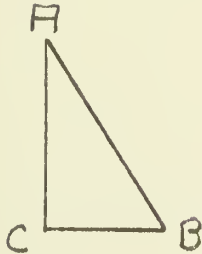
EQUILLATERAL TRIANGLE

ISOSCELES TRIANGLE

OCTAGON

RIGHT TRIANGLE

11.



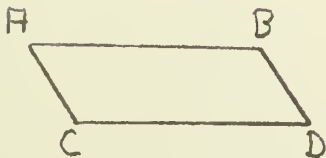
$$\overline{AB} \sim \overline{CB}$$

$$\overline{CB} \not\sim \overline{AC}$$

$$\overline{AC} \sim \overline{AB}$$

$$\overline{BA} \sim \overline{AC}$$

12.



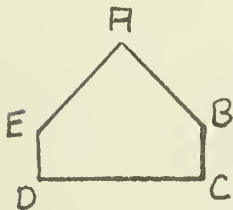
$$\overline{AB} \not\sim \overline{CD}$$

$$\overline{AB} \sim \overline{BD}$$

$$\overline{AC} \sim \overline{BD}$$

$$\overline{BD} \sim \overline{CD}$$

13.



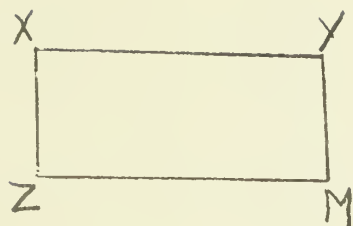
$$\overline{AB} \not\sim \overline{AE}$$

$$\overline{AE} \sim \overline{ED}$$

$$\overline{AB} \sim \overline{AE}$$

$$\overline{DC} \sim \overline{BC}$$

14.



XY PARALLEL TO ZM

XY PARALLEL TO XZ

ZM PARALLEL TO YM

ZM PARALLEL TO XZ

15.



$\angle ABC \cong \angle ACB$

$\angle BCA \cong \angle CBA$

$\angle ABC \cong \angle CAB$

$\angle CBA \cong \angle BCA$

TRUE OR FALSE

DIRECTIONS: LOOK AT THE GEOMETRIC FIGURE AND READ THE STATEMENT FOR EACH QUESTION. DRAW A CIRCLE AROUND THE T IF YOU THINK THE STATEMENT IS TRUE. DRAW A CIRCLE AROUND THE F IF YOU THINK THE STATEMENT IS FALSE.

EXAMPLE:

THIS GEOMETRIC FIGURE IS A POINT.

T **F**



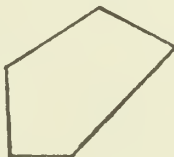
1. SEGMENT A B IS CONGRUENT TO SEGMENT C D.

T F



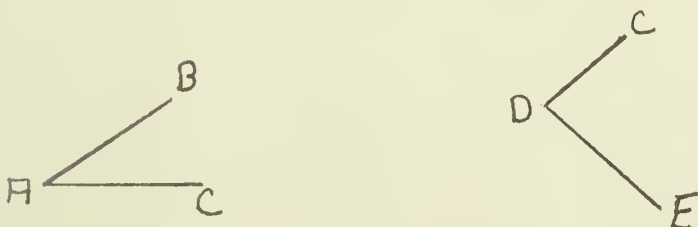
2. THIS GEOMETRIC FIGURE IS A POLYGON.

T F



3. ANGLE B A C IS NOT CONGRUENT TO ANGLE C D E.

T F



4. THIS GEOMETRIC FIGURE IS CALLED AN OCTOGON.

T F



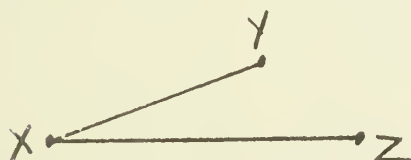
5. THIS GEOMETRIC FIGURE IS CALLED AN EQUILATERAL TRIANGLE.

T F



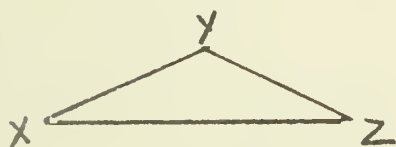
6. SEGMENT X Y IS CONGRUENT TO SEGMENT X Z.

T F



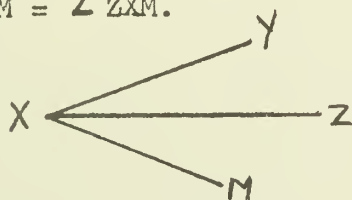
7. $\angle XYZ \cong \angle ZKY$.

T F



8. $\angle YXM \cong \angle ZXM$.

T F



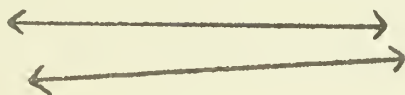
9. THIS GEOMETRIC FIGURE IS A POLYGON.

T F



10. THESE LINES ARE PARALLEL.

T F



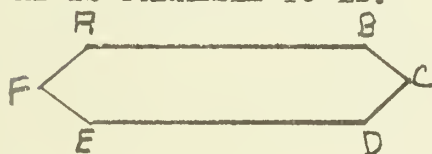
11. THIS FIGURE IS A HEXAGON.

T F



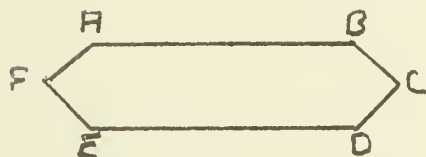
12. \overline{AB} IS PARALLEL TO \overline{ED} .

T F



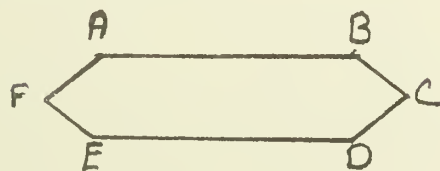
13. \overline{BC} IS PARALLEL TO \overline{FE} .

T F



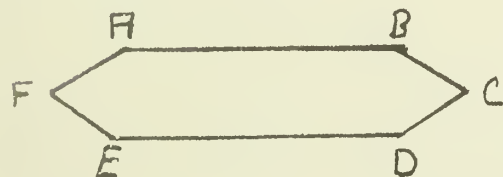
14. $\angle ABC \cong \angle BCD$.

T F



15. $\angle AFE \cong \angle BCD$

T F

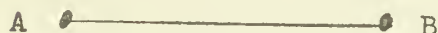


RULER AND PENCIL EXERCISE

DIRECTIONS: DRAW THE FOLLOWING GEOMETRIC FIGURES.

USE YOUR RULER AND PENCIL.

EXAMPLE: DRAW A SEGMENT \overline{AB} .



1. ISOSCELES TRIANGLE

2. SQUARE

3. RECTANGLE

4. PENTAGON

5. HEXAGON

6. PARALLELOGRAM

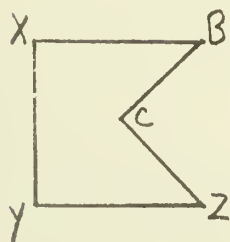
7. QUADRILATERAL

8. POLYGON

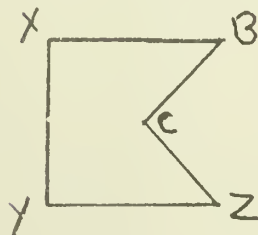
9. RIGHT TRIANGLE

10. EQUILLATERAL TRIANGLE

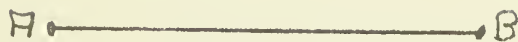
11. DRAW AN ANGLE \cong TO ANGLE XYZ.



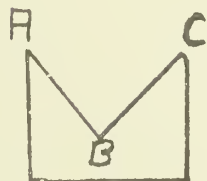
12. DRAW AN ANGLE \cong TO ANGLE BCZ.



13. DRAW A SEGMENT CD THAT IS PARALLEL TO SEGMENT AB.



14. DRAW AN ANGLE THAT WOULD FIT INTO SPACE ABC.



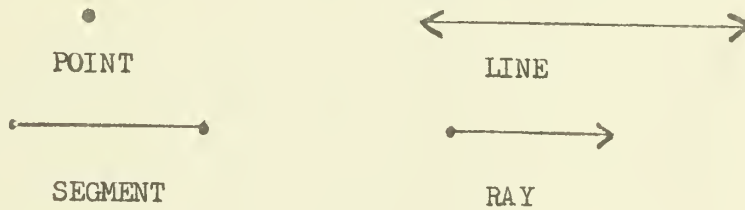
15. DRAW A GEOMETRIC FIGURE THAT HAS 4 PARALLEL LINES.

APPENDIX E

GEOMETRY
For
ELEMENTARY GRADES
STUDENT'S TEXT

SOME FIGURES OF GEOMETRY

SOME OF THE BASIC FIGURES OF GEOMETRY ARE PICTURED BELOW.
OTHER FIGURES OF GEOMETRY ARE MADE UP OF THESE FIGURES.



1. MARK A POINT ON YOUR PAPER.
USE YOUR RULER TO DRAW 5
DIFFERENT LINES THAT PASS
THROUGH THAT POINT.

2. MARK A POINT ON YOUR PAPER.
USE YOUR RULER TO DRAW 3
DIFFERENT RAYS FROM THAT POINT.

3. (A) MARK TWO POINTS ON YOUR PAPER.
USE YOUR RULER TO DRAW A LINE
THAT PASSES THROUGH THESE TWO POINTS.

- (B) MARK TWO OTHER POINTS ON YOUR
PAPER. DRAW THE LINE SEGMENT
FOR THESE POINTS.

4. MARK 3 POINTS AS IN THE FIGURE.
DRAW LINE SEGMENTS TO CONNECT
THOSE POINTS.



- a. HOW MANY SEGMENTS DID YOU DRAW?
- b. WHAT IS THE NAME OF THE FIGURE YOU HAVE DRAWN?

5. MARK ONE POINT ON YOUR PAPER.
DRAW TWO RAYS FROM THIS POINT.
THE FIGURE YOU HAVE DRAWN IS AN ANGLE.

6. (A) DRAW A FIGURE THAT IS MADE UP OF 4 LINE SEGMENTS.

- (B) DRAW A FIGURE THAT IS MADE UP OF 5 LINE SEGMENTS.

7. DRAW AN ANGLE.

MARK A POINT ON EACH RAY OF THE ANGLE.

CONNECT THESE TWO POINTS. (DO YOU SEE A TRIANGLE?)

EACH ANGLE FORMS ONE OF THE CORNERS OF THE TRIANGLE.

EACH TRIANGLE HAS 3 SIDES. (SEGMENTS)

EACH TRIANGLE ALSO HAS 3 ? .

DRAW YOUR FIGURE IN THE SPACE PROVIDED BELOW.

8. DRAW A LINE FROM POINT A TO POINT B.



NOTICE THAT SEGMENT \overline{AB} IS THE SAME LENGTH AS SEGMENT \overline{CD} .

THESE SEGMENTS ARE CONGRUENT BECAUSE THEY ARE THE SAME LENGTH.

TWO SEGMENTS ARE CONGRUENT TO EACH OTHER IF THEIR ENDS ARE EQUALLY FAR APART.

THIS STATEMENT CAN BE WRITTEN: $AB \cong CD$

9. DRAW A LINE FROM POINT A TO POINT B.



NOTICE THAT SEGMENT \overline{AB} IS LONGER THAN SEGMENT \overline{CD} .

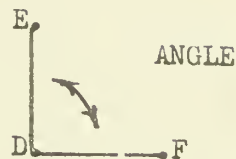
THESE SEGMENTS ARE NOT CONGRUENT BECAUSE THEY ARE NOT THE SAME LENGTH.

10. DRAW SEGMENTS \overline{AB} AND \overline{CD} THAT ARE CONGRUENT.

11. DRAW SEGMENTS \overline{AB} AND \overline{CD} THAT ARE NOT CONGRUENT.

12. DPAW SEVERAL SEGMENTS. (MAKE THEM CONGRUENT AND NOT
CONGRUENT.)

13. DRAW A LINE FROM POINT B TO POINT A AND FROM POINT A TO POINT C.



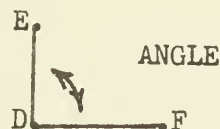
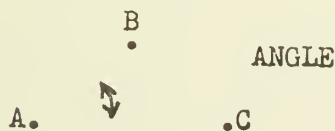
NOTICE THAT SEGMENTS \overline{AB} AND \overline{AC} ARE CONGRUENT.

NOTICE THAT SEGMENTS \overline{AB} AND \overline{AC} ARE CONGRUENT TO SEGMENTS \overline{DE} AND \overline{DF} .

NOTICE THAT THE SEGMENTS MAKE AN ANGLE AND THAT THE ANGLES ARE THE SAME SIZE. WE CAN SAY THAT ANGLE ABC IS CONGRUENT TO ANGLE EDF. WE CAN WRITE THIS: $\angle ABC \cong \angle EDF$

TWO ANGLES ARE CONGRUENT TO EACH OTHER IF NEITHER IS LARGER THAN THE OTHER.

14. DRAW A LINE FROM POINT B , TO POINT A AND FROM POINT A , TO POINT C.



NOTICE THAT THE ANGLES OR THESE TWO FIGURES ARE NOT CONGRUENT.

NOTICE THAT THE SEGMENTS AB AND DE ARE NOT CONGRUENT.

NOTICE THAT THE SEGMENTS AC AND DF ARE CONGRUENT.

LOOK AT THE SURROUNDINGS IN YOUR CLASSROOM. CAN YOU FIND CONGRUENT LINES AND ANGLES? THINK OF WHERE YOU HAVE SEEN THESE FIGURES OUTSIDE THE CLASSROOM.

15. DRAW 2 ANGLES THAT ARE CONGRUENT. MAKE THE SEGMENTS OF THE ANGLES ANY LENGTH YOU WISH.

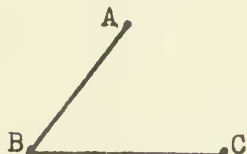
$$\angle ABC \cong \angle DEF$$

16. DRAW 2 ANGLES THAT ARE NOT CONGRUENT.
MAKE THE SEGMENTS OF THE ANGLES ANY LENGTH YOU WISH.

$$\angle ABC \not\cong \angle DEF$$

TRIANGLES

17. DRAW A LINE FROM POINT A TO POINT C



THIS GEOMETRIC FIGURE IS CALLED A TRIANGLE. NOTICE THAT A TRIANGLE HAS 3 SIDES AND 3 ANGLES. (NOT ALWAYS CONGRUENT.)

HERE ARE OTHER TRIANGLES TO EXAMINE.



EQUILATERAL - 3 congruent sides.
3 congruent angles.



ISOSCELES - 2 congruent sides.
3 angles but only 2 that are congruent.

18. DRAW AN EQUILATERAL TRIANGLE.

19. DRAW AN ISOSCELES TRIANGLE.

20. DRAW A TRIANGLE WITH SIDES AND ANGLES THAT ARE NOT CONGRUENT.
(\ncong)

21. DRAW A TRIANGLE WITH SIDES AND ANGLES THAT ARE CONGRUENT.
(\cong)

22. DRAW A LINE FROM POINT A TO POINT B AND C AND D THEN BACK TO POINT A.

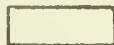


THIS GEOMETRIC FIGURE IS A QUADRILATERAL. IT HAS 4 SIDES AND 4 ANGLES.

HERE ARE TWO OTHER QUADRILATERALS TO STUDY. NOTICE THAT THEY HAVE 4 SIDES AND 4 ANGLES AND THAT SOME QUADRILATERALS HAVE CONGRUENT SIDES AND ANGLES.



SQUARE - 4 congruent sides and angles.



RECTANGLE - 2 long congruent sides
2 short congruent sides
4 congruent angles

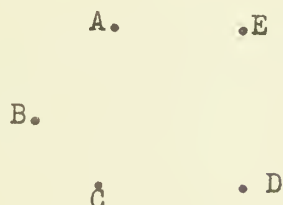
23. DRAW A QUADRILATERAL WITH \cong SIDES AND \cong ANGLES.

24. DRAW A SQUARE.

25. DRAW A RECTANGLE.

PENTAGON

26. DRAW A LINE FROM POINT A TO POINT B AND D AND E , THEN BACK TO POINT A.



THIS GEOMETRIC FIGURE IS A PENTAGON WITH FIVE SIDES AND FIVE ANGLES.

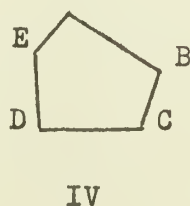
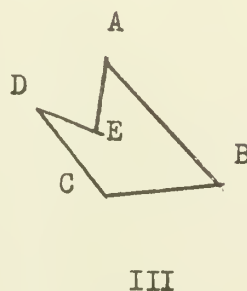
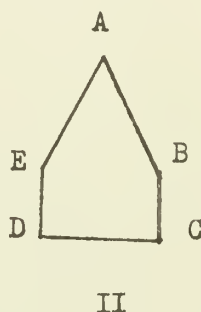
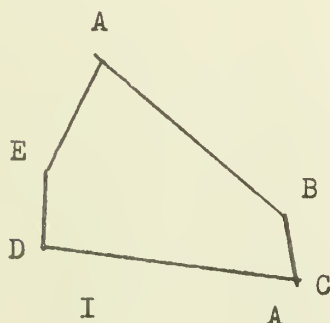
NOTICE THAT THE SIDES ARE NOT ALL CONGRUENT AND THAT THE ANGLES ARE NOT ALL CONGRUENT.

27. DRAW A LINE FROM POINT A TO POINT B AND C AND D AND E , THEN BACK TO POINT A.



THIS PENTAGON HAS CONGRUENT SIDES AND CONGRUENT ANGLES.

STUDY THE FOLLOWING PENTAGONS AND SEE IF YOU CAN POINT OUT THE SIDES AND ANGLES THAT ARE CONGRUENT.



28. COMPARE THE ANGLES AND SEGMENTS IN EXERCISE 27, AND WRITE THEM OUT.

EXAMPLE

FIGURE I = $\overline{AE} \cong \overline{AB}$

$\angle ABC \cong \angle BCD$

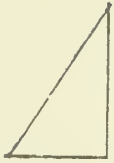
FIGURE I

FIGURE II

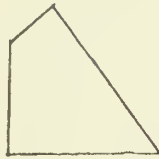
FIGURE III

FIGURE IV

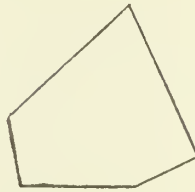
POLYGON - A GEOMETRIC FIGURE WITH UNEQUAL SIDES AND UNEQUAL ANGLES.



TRIANGLE



QUADRILATERAL



PENTAGON



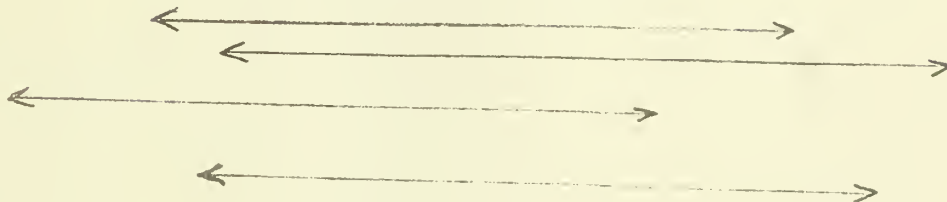
HEXAGON

29. DRAW YOUR OWN POLYGON. (SIDES AND ANGLES THAT ARE NOT CONGRUENT.)

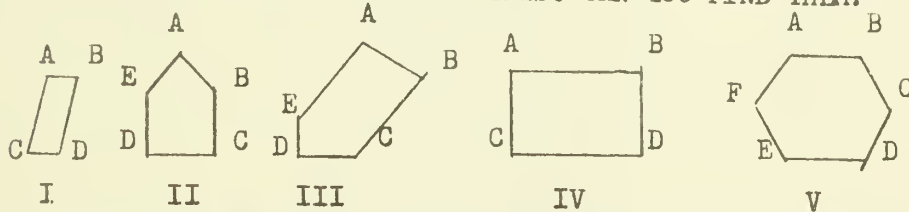
30. DRAW TRIANGLES, QUADRILATERALS, PENTAGONS, AND HEXAGONS THAT HAVE CONGRUENT SIDES AND ANGLES.

PARALLEL LINES

PARALLEL LINES - LINES PLACED ONE BESIDE ANOTHER AND EQUIDISTANT AT ALL POINTS ALONG THE LINES.



THE FIGURES BELOW HAVE PARALLEL LINES. CAN YOU FIND THEM?



31. COMPARE THE SEGMENTS IN EACH FIGURE AND WRITE THEM OUT.

EXAMPLE : FIGURE I = \overline{AB} PARALLEL TO \overline{CD} .

FIGURE II =

FIGURE III =

FIGURE IV =

FIGURE V =

32. DRAW SEVERAL GEOMETRIC FIGURES THAT HAVE PARALLEL LINES.

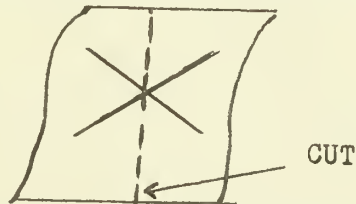
33. DRAW SEVERAL GEOMETRIC FIGURES THAT HAVE NO PARALLEL LINES.

MORE ABOUT PARALLEL LINES

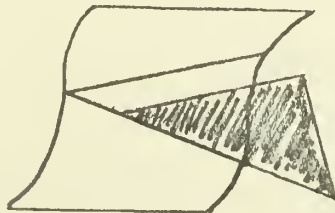
YOU CAN DRAW A PAIR OF PARALLEL LINES BY DRAWING ON EACH SIDE OF YOUR RULER. TRY THIS METHOD.

34. HERE IS A WAY TO USE ANGLES TO GET PARALLEL LINES.

- A. DRAW TWO LINES THAT CROSS EACH OTHER.
- B. COLOR THE INSIDE OF THE ANGLE.
- C. CUT YOUR PAPER AS SHOWN IN THE PICTURE. (CUT ON DOTTED LINE.)
- D. CUT OUT THE ANGLE YOU HAVE COLORED.



PLACE THE ANGLE YOU HAVE COLORED ALONG ONE SIDE OF THE OTHER ANGLE. DO YOU SEE SOME PARALLEL LINES?



NOW TRY TO FIND A DIFFERENT WAY OF PLACING THE ANGLE TO GET PARALLEL LINES.

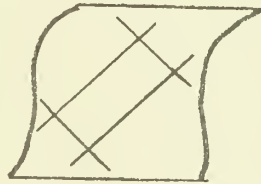
35. SCOTCH TAPE THE COLORED ANGLE TO A BLANK PIECE OF PAPER.
NOW DRAW PARALLEL LINES TO THE SIDES OF THAT ANGLE.

USE THIS SPACE.

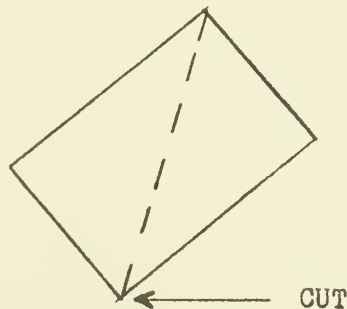
PARALLELOGRAM

IN THE LAST LESSON YOU LEARNED HOW TO DRAW PARALLEL LINES.
TO DRAW A PARALLELOGRAM, YOU NEED TO DRAW TWO PAIRS OF PARALLEL
LINES THAT INTERSECT.

36. DRAW TWO PAIRS OF PARALLEL LINES THAT CROSS EACH OTHER.



- A. COLOR THE INSIDE OF YOUR PARALLELOGRAM AND CUT IT OUT.
- B. USE YOUR RULER TO CONNECT OPPOSITE CORNERS. THEN CUT ALONG
THE LINE. IF YOU DID YOUR WORK CAREFULLY, THE TWO TRIANGLES
SHOULD FIT UPON EACH OTHER.



NOW PLACE ONE TRIANGLE NEXT TO THE OTHER SO THAT THE TWO TRIANGLES
TOGETHER FORM A PARALLELOGRAM.

APPENDIX F

TABLE 8
UNOBTRUSIVE MEASUREMENT DATA

GROUP	No.	LIBRARY		LIBRARY MATERIALS	ADD. SESSIONS	
		DID	DID NOT		DID	DID NOT
CONTROL	23	18	5	87	18	5
EXP.	23	21	2	147	13	10

TABLE 9
DATA FOR COMPARING PITCH WITH ACHIEVEMENT

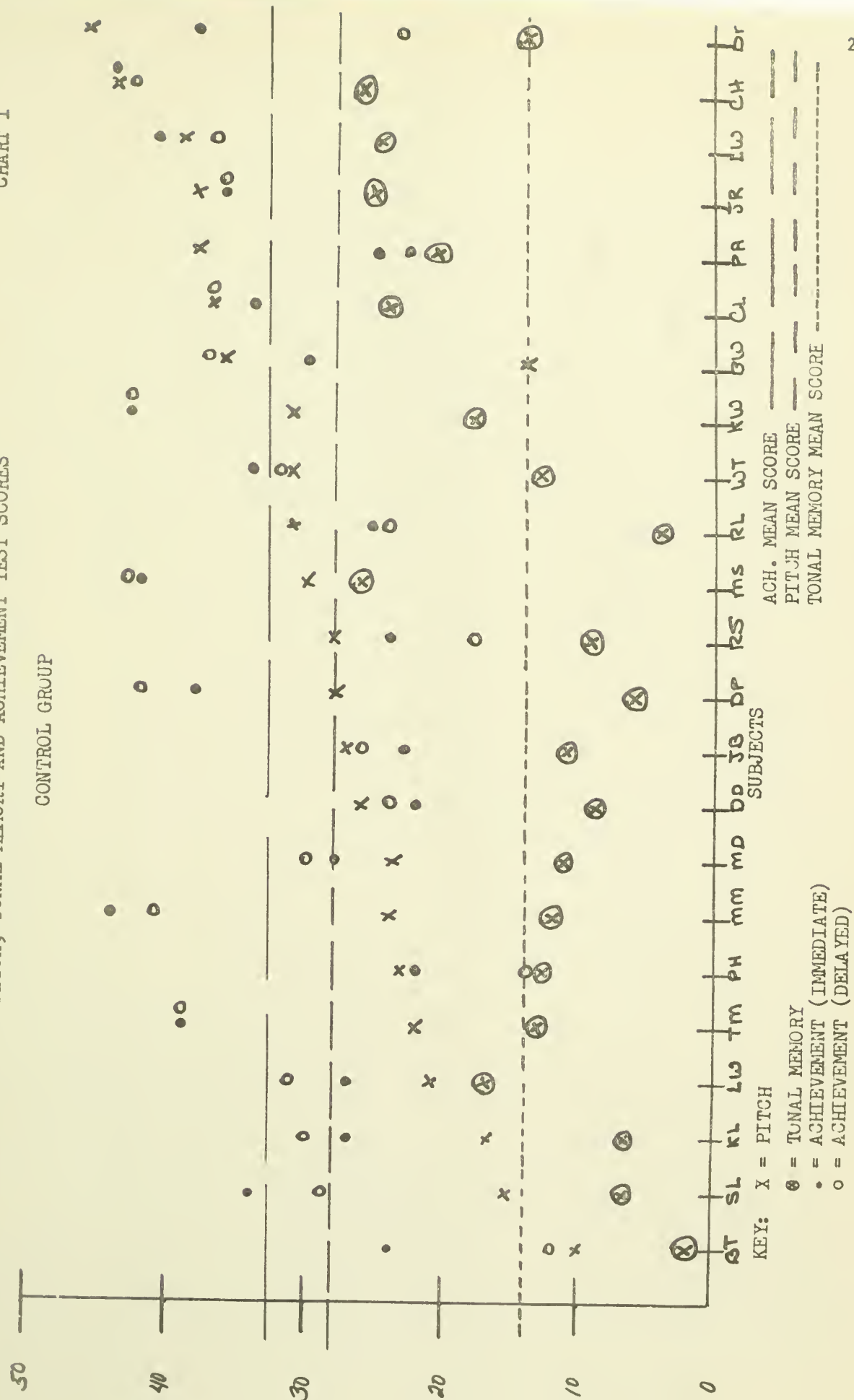
GROUP	PITCH	ACHIEVEMENT (Immediate) ABOVE MEAN	ACHIEVEMENT (Delayed) ABOVE MEAN
	BELOW MEAN		
CONTROL	10	3	2
EXP.	12	8	9

TABLE 10
DATA FOR COMPARING TONAL MEMORY WITH ACHIEVEMENT

GROUP	TONAL MEMORY	ACHIEVEMENT (Immediate) ABOVE MEAN	ACHIEVEMENT (Delayed) ABOVE MEAN
	BELOW MEAN		
CONTROL	13	4	4
EXP.	11	6	7

PITCH, TONAL MEMORY AND ACHIEVEMENT TEST SCORES

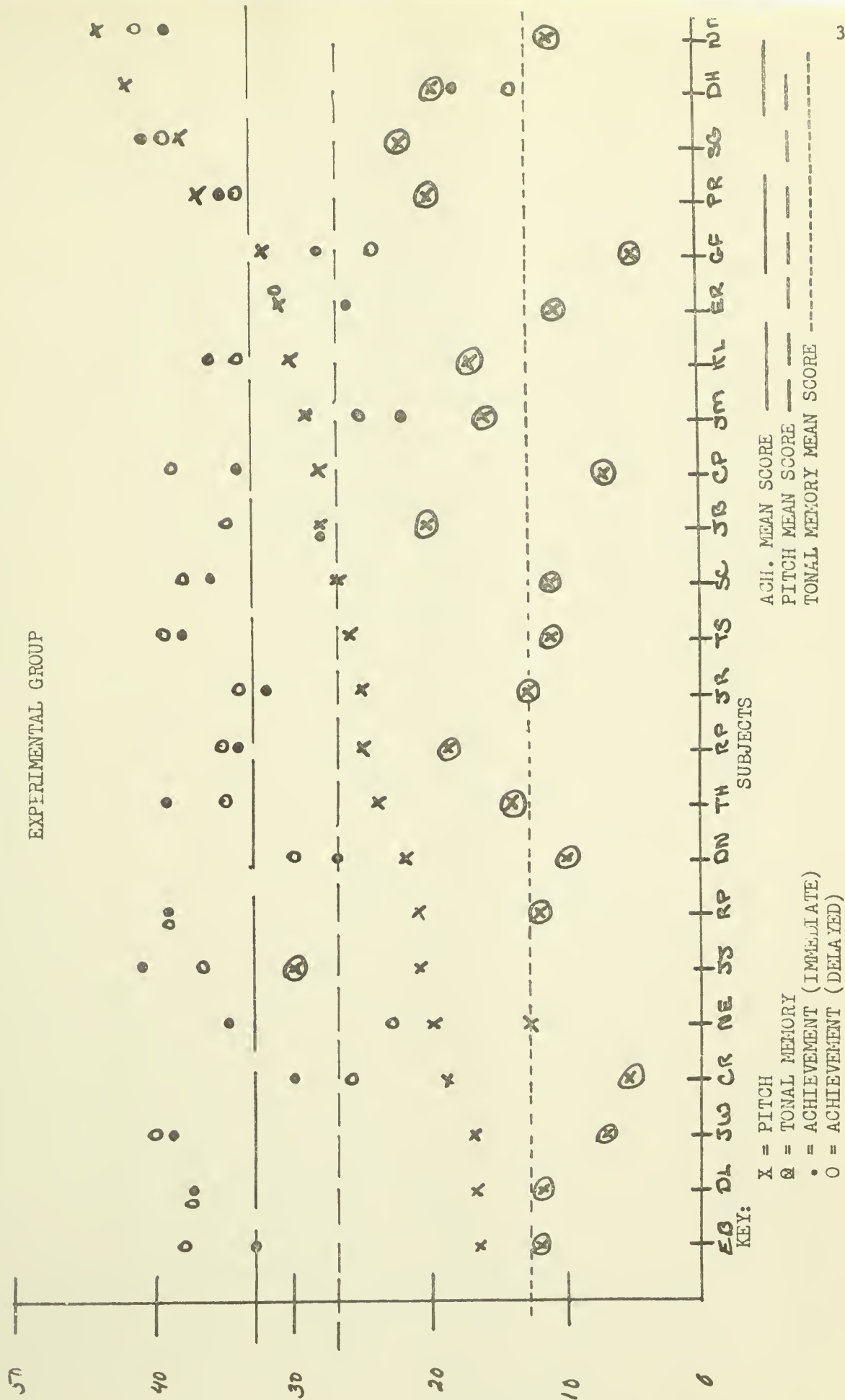
CHART I



PITCH, TONAL MEMORY AND ACHIEVEMENT TEST SCORES

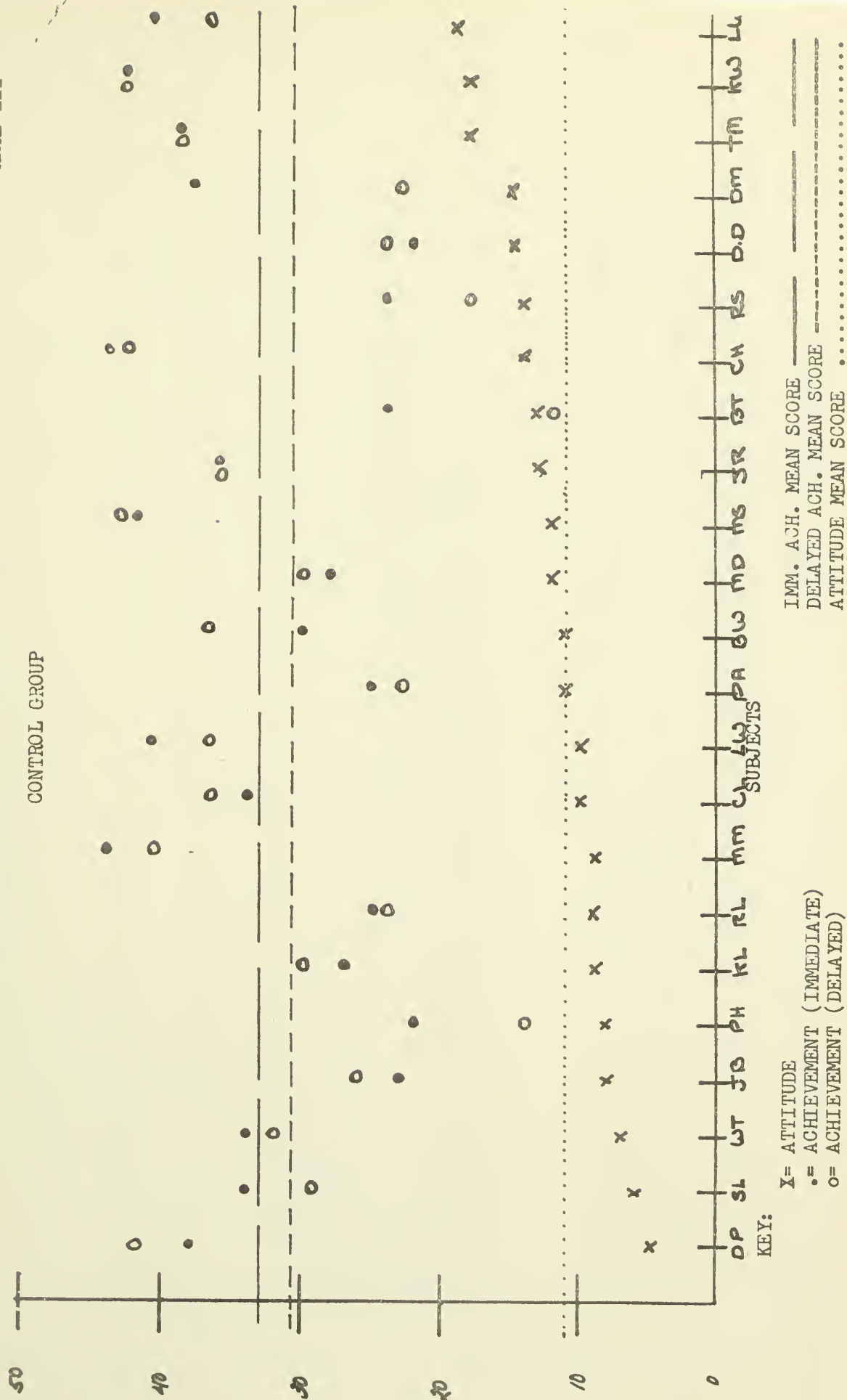
CHART II

EXPERIMENTAL GROUP



ATTITUDE AND ACHIEVEMENT TEST SCORES

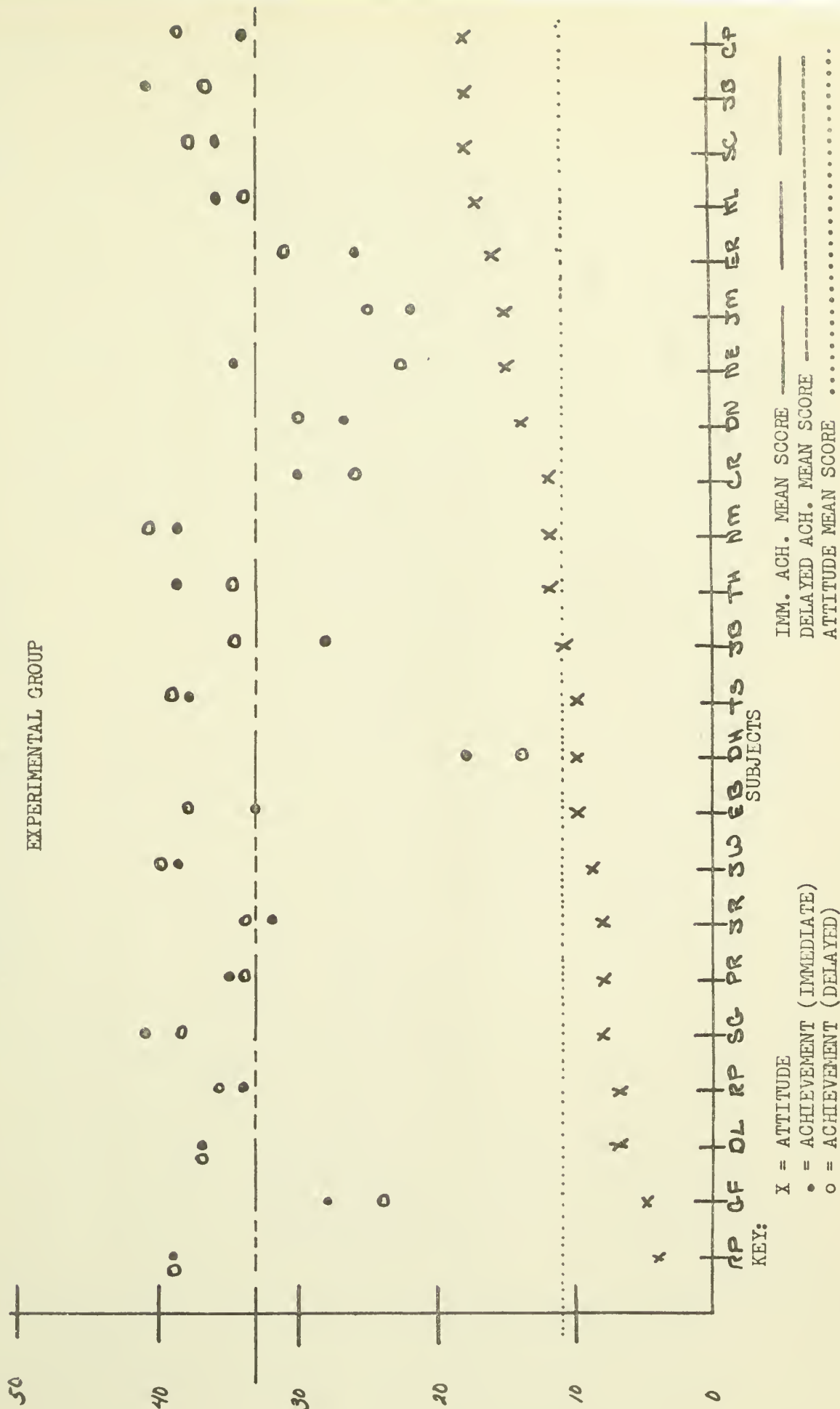
CHART III



ATTITUDE AND ACHIEVEMENT TEST SCORES

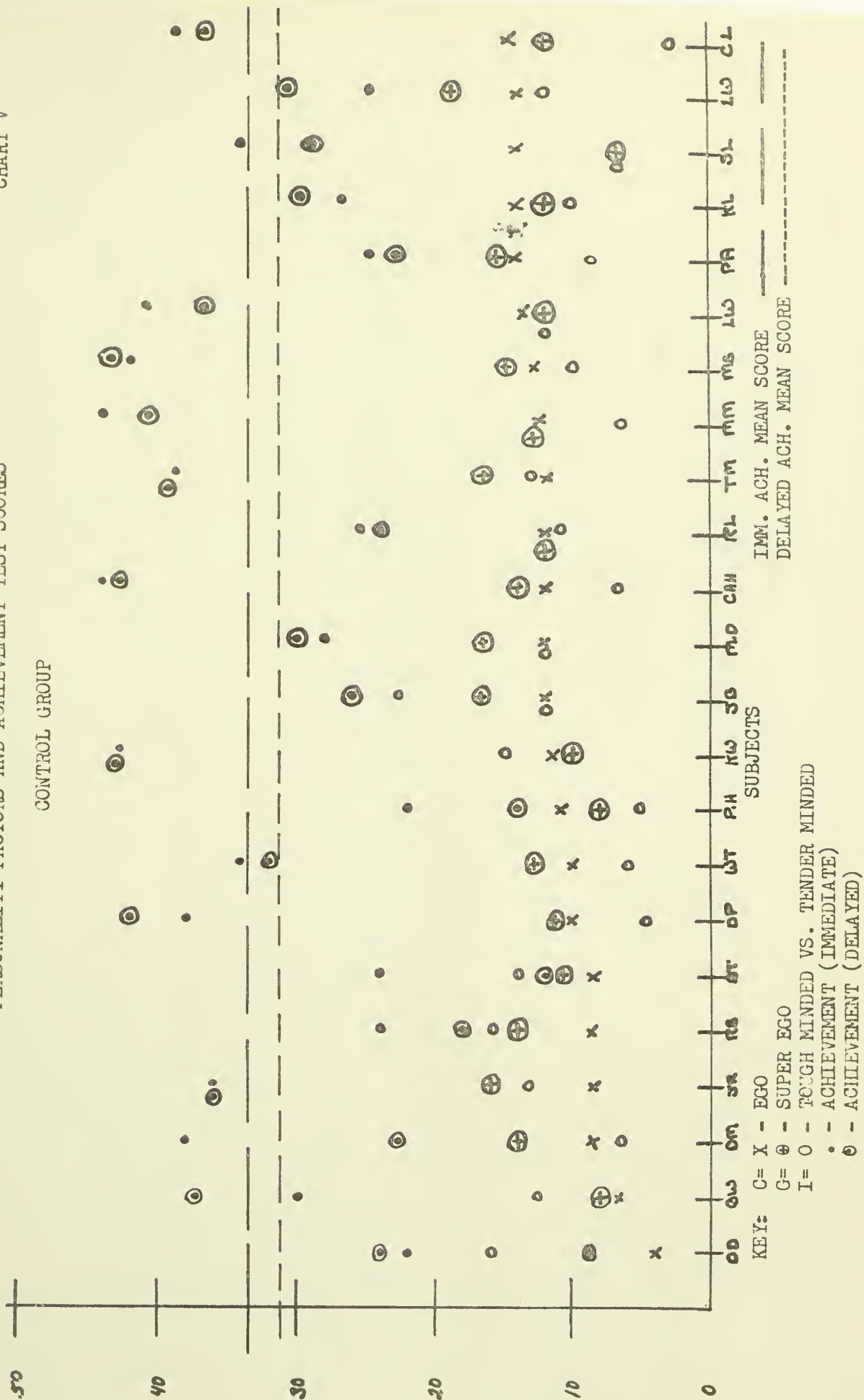
CHART IV

EXPERIMENTAL GROUP



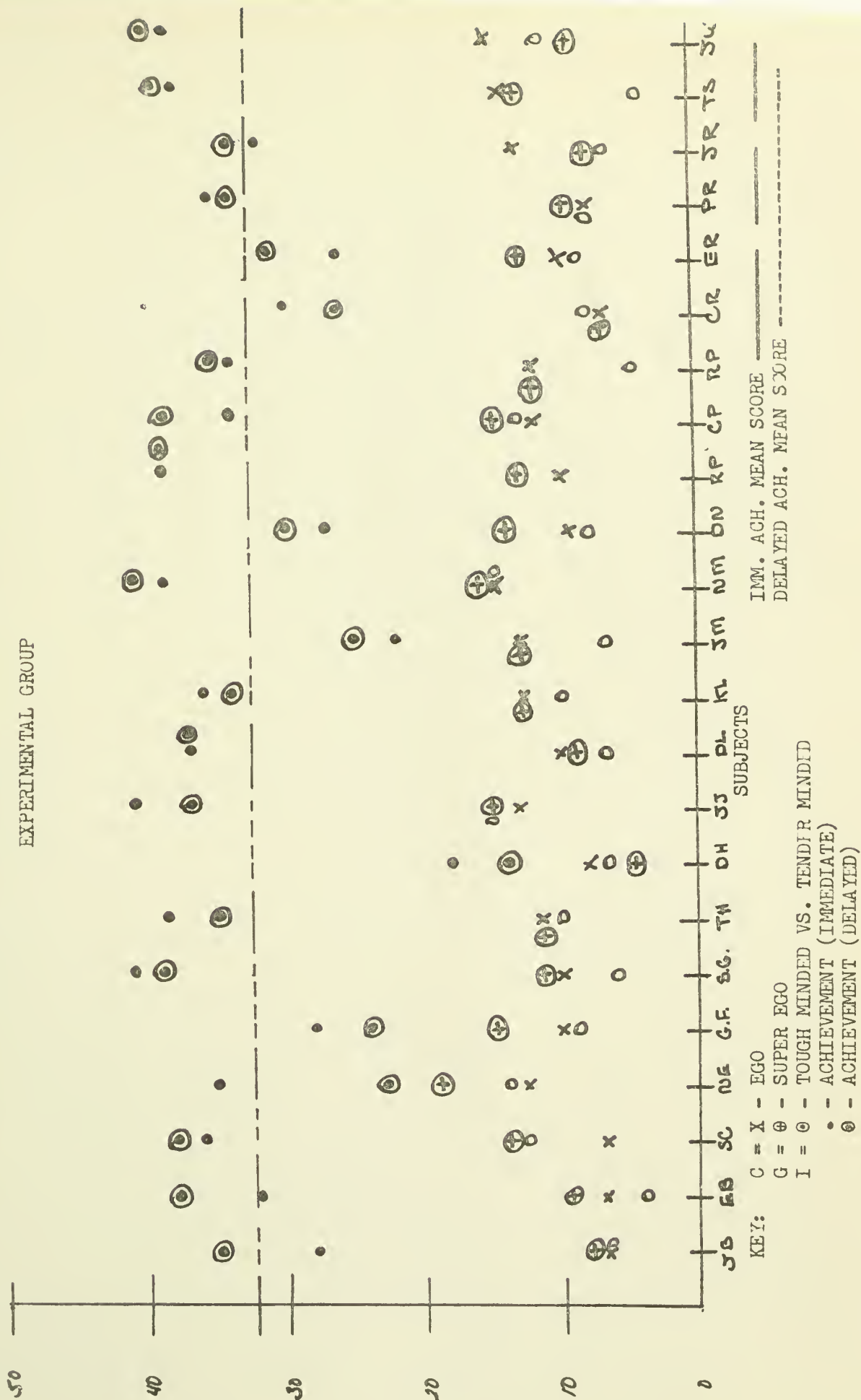
PERSONALITY FACTORS AND ACHIEVEMENT TEST SCORES

CHART V



PERSONALITY FACTORS AND ACHIEVEMENT TEST SCORES

CHART VI



A REVIEW OF THE STATISTICAL ANALYSIS OF THE DATA

* Statistical Test Concerning the Comprehension Variable

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S(\bar{X}_1 - \bar{X}_2)}$$

$$\text{Where } S(\bar{X}_1 - \bar{X}_2) = \sqrt{\frac{2s^2}{n}}$$

$$t = \frac{33.347 - 32.565}{2.089}$$

$$\text{To find } s^2 = \frac{\sum x^2_1 + \sum x^2_2}{n_1 + n_2 - 2}$$

$$t = .374$$

$$s^2 = \frac{855.842 + 1353.853}{44}$$

$$s^2 = 50.220$$

$$S(\bar{X}_1 - \bar{X}_2) = \sqrt{\frac{2 \times 50.220}{23}}$$

$$S(\bar{X}_1 - \bar{X}_2) = 2.089$$

* Statistical Test Concerning the Retention Variable

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S(\bar{X}_1 - \bar{X}_2)}$$

$$\text{Where } S(\bar{X}_1 - \bar{X}_2) = \sqrt{\frac{2s^2}{n}}$$

$$t = \frac{31.043 - 33.347}{2.413}$$

$$\text{To find } s^2 = \frac{\sum x^2_1 + \sum x^2_2}{n_1 + n_2 - 2}$$

$$t = .954$$

$$s^2 = \frac{1926.937 + 1019.568}{44}$$

$$s^2 = 66.966$$

$$S(\bar{X}_1 - \bar{X}_2) = \sqrt{\frac{2 \times 66.966}{23}}$$

$$S(\bar{X}_1 - \bar{X}_2) = 2.413$$

Statistical Test Concerning the Motivation Variable

Library attendance

	Did Not	Did	Total
Control	5	18	23
Exper.	2	21	23
Total	7	39	46 = N

	Did Not	Did	Total
Control	A	B	
Exper.	C	D	
Total			

$$\chi^2 = \frac{N \left(\frac{AD-BC}{(A+B)(C+D)(A+C)(B+D)} - \frac{1}{2} \right)^2}{\left(\frac{1}{(A+B)(C+D)(A+C)(B+D)} \right)}$$

$$\chi^2 = \frac{46 \left(\frac{5 \times 21 - 2 \times 18}{23 \times 23 \times 7 \times 39} - \frac{1}{2} \right)^2}{\left(\frac{1}{23 \times 23 \times 7 \times 39} \right)}$$

$$\chi^2 = \frac{46 \times 2116}{114417}$$

$$\chi^2 = .673$$

Chi-square distribution test.

S. Siegel p.109.

Saturday morning attendance

	Did Not	Did	Total
Control	10	13	23
Exper.	5	18	23
Total	15	31	46 = N

	Did Not	Did	Total
Control	A	B	
Exper.	C	D	
Total			

$$\chi^2 = \frac{N \left(\frac{AD-BC}{(A+B)(C+D)(A+C)(B+D)} - \frac{1}{2} \right)^2}{\left(\frac{1}{(A+B)(C+D)(A+C)(B+D)} \right)}$$

$$\chi^2 = \frac{46 \left(\frac{5 \times 13 - 18 \times 10}{23 \times 23 \times 15 \times 31} - \frac{1}{2} \right)^2}{\left(\frac{1}{23 \times 23 \times 15 \times 31} \right)}$$

$$\chi^2 = \frac{46 \times 8464}{245985}$$

$$\chi^2 = 1.582$$

Chi-square distribution test.

S. Siegel p.109.

Number of times students used the materials in the library.

	Exp.	Control	$\Sigma's$
ABOVE 7.5→	a 9	b 4	13
BELOW	c 14	d 19	33
$\Sigma's$	23 (+)	23	(=) 46 = n

$$\chi^2 = \frac{n(ad-bc - \frac{n}{2})^2}{(a+b)(c+d)(a+c)(b+d)}$$

$$\chi^2 = \frac{46(9 \times 19 - 4 \times 14 - \frac{46}{2})^2}{13 \times 33 \times 23 \times 23}$$

$$\chi^2 = \frac{46 \times 8464}{226944}$$

Median, Chi-square distribution test.

$$\chi^2 = 1.715$$

G. Milton Smith p. 209.

** Statistical Test Concerning Correlation Between Attitude and Achievement

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \times \sum y^2}}$$

$$r = \frac{94.027}{\sqrt{2209.695 \times 731.589}}$$

$$r = \frac{94.027}{1271.451}$$

$$r = .073$$

** Statistical Test Concerning Correlation Between Pitch and Achievement

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \times \sum y^2}}$$

$$r = \frac{911.660}{\sqrt{2672.788 \times 2690.578}}$$

$$r = \frac{911.660}{2681.668}$$

$$r = .339$$

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

$$t = \frac{.339\sqrt{46-2}}{\sqrt{1-(.339)^2}}$$

$$t = \frac{2.248}{.941}$$

$$t = 2.388$$

** Statistical Test Concerning Correlation Between Tonal Memory and Achievement.

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \times \sum y^2}}$$

$$r = \frac{789.609}{\sqrt{2070.035 \times 2209.695}}$$

$$r = \frac{789.609}{2138.725}$$

$$r = .369$$

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} \quad t = \frac{2.447}{.929}$$

$$t = \frac{.369\sqrt{46-2}}{\sqrt{1-(.369)^2}} \quad t = 2.634$$

** Pearson product-moment correlation coefficient formula.

G. Milton Smith p. 158.

** Statistical Test Concerning Correlation Between Rhythm and Achievement.

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \times \sum y^2}}$$

$$r = \frac{25.227}{\sqrt{2209.695 \times 940.295}}$$

$$r = \frac{25.227}{1441.445}$$

$$r = .017$$

** Statistical Test Concerning Correlation Between Personality Factor "C" and Achievement.

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \times \sum y^2}}$$

$$r = \frac{290.241}{\sqrt{2209.695 \times 306.000}}$$

$$r = \frac{290.241}{822.293}$$

$$r = .352$$

$$t = \frac{r \sqrt{n-2}}{\sqrt{1-r^2}}$$

$$t = \frac{.352 \sqrt{46-2}}{\sqrt{1-(.352)^2}}$$

$$t = \frac{2.334}{.935}$$

$$t = 2.496$$

** Statistical Test Concerning Correlation Between Personality Factor "G" and Achievement.

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \times \sum y^2}}$$

$$r = \frac{151.134}{\sqrt{2209.695 \times 488.646}}$$

$$r = \frac{151.134}{1039.115}$$

$$r = .145$$

** Pearson product-moment correlation coefficient formula.

G. Milton Smith p. 158.

Statistical Test Concerning Correlation Between Personality Factor "I" and Achievement.

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \times \sum y^2}}$$

$$r = \frac{118.634}{\sqrt{2209.695 \times 583.706}}$$

$$r = \frac{118.634}{1135.699}$$

Pearson product-moment correlation coefficient formula.

$$r = .104$$

G. Milton Smith p. 158.

Statistical Test Concerning Reliability of Attitude Test

$$r_{11} = \frac{n}{n-1} \left[1 - \frac{M_t \left(1 - \frac{M_t}{n} \right)}{S_t^2} \right]$$

$$r_{11} = \frac{20}{19} \left[1 - \frac{11.000 \left(1 - \frac{11.000}{20} \right)}{5.406^2} \right]$$

$$r_{11} = 1.052 \left[1 - \frac{11.000 \times .450}{29.224} \right]$$

Kuder-Richarson Formula 21
30 Subjects, 45 Items.

$$r_{11} = .874$$

Thordike and Hagen p. 185

$$S_m = S_t \sqrt{1 - r_{11}}$$

$$S_m = 5.406 \times .354$$

Standard error of measurement.

$$S_m = 1.913$$

Thorndike and Hagen p. 187.

$$r_{nn} = \frac{n(r_{11})}{1 + (n-1)r_{11}}$$

$$r_{nn} = \frac{4.35}{3.48}$$

Reliability to length formula.

$$r_{nn} = \frac{5(.87)}{1+4(.87)}$$

$$r_{nn} = 1.25$$

Thorndike and Hagen p. 192.

Statistical Test Concerning Reliability of the Achievement Test

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \times \sum y^2}}$$

$$t = \frac{r \sqrt{n-2}}{\sqrt{1-r^2}}$$

$$r = \frac{743.999}{\sqrt{1406.300 \times 644.651}}$$

$$t = \frac{.78 \times 30-2}{\sqrt{1- (.78)^2}}$$

$$r = \frac{743.999}{952.141}$$

$$t = \frac{4.132}{.625}$$

$$r = .78$$

$$t = 6.611$$

Pearson product-moment correlation coefficient formula.

G. Milton Smith p. 158.

STATISTICAL DATA

Experimental Group

Subjects	Sex	C.A.	I.Q.	Pre. Ach. 15 items	Post Ach. 45 items	Delayed Ach. 45 items	Attitude to Arts	* Personality					Music P. - TM. - R.		
								C	G	I					
J.B.	M	10-11	90	-	28	35	11	7	8	-	0	+	28	21	16
E.B.	M	9-4	100	-	33	38	10	7	9	4			17	12	24
S.C.	F	10-5	115	11	36	38	18	7					27	11	25
N.E.	F	9-8	117	-	35	23	15		14	19			20	13	22
G.F.	M	10-3	95	11	28	24	5	13	15	9			32	5	19
S.G.	M	9-9	113	-	41	39	8	10	11	6			38	22	28
T.H.	F	9-6	101	-	39	35	12	10	11	10			24	14	12
D.H.	M	10-4	83	-	18	14	10	8	5	7			42	19	27
J.J.	F	9-10	125	10	41	37	18	13	15	15			21	30	25
D.L.	M	9-7	113	10	37	37	7	10	9	7			17	10	26
K.L.	F	9-4	115	8	36	34	17	13	13	10			30	17	27
J.M.	F	10-2	88	-	22	25	15	13	13	7			29	16	21
N.M.	F	10-0	130	11	39	41	12	15		16			44	11	25
D.N.	F	10-5	97	-	27	30	14	9	14	8			22	9	18
R.P.	M	9-4	124	-	39	39	7		13	3			21	13	22
C.P.	F	10-3	116	-	34	39	18	12	15				28	7	23
R.P.	M	10-9	89	7	34	35	4	12	12	5			25	19	26
C.R.	M	10-3	91	10	30	26	12	7	7	8			19	5	19
E.R.	F	10-3	108	9	26	31	16	10	13	9			31	11	20
P.R.	M	9-8	123	-	35	34	8	8	9	8			37	20	26
J.R.	M	10-8	90	8	32	34	8	13	8	7			25	13	39
T.S.	M	10-3	104	9	38	39	10	14	13	4			26	11	19
J.W.	M	9-5	121	-	39	40	9	15	9	11			17	7	14

* Below average (-), Average (0), Above average (+) scores based upon maturity of students and other variables referred to in the I.P.A.T. Questionnaire Manual.

STATISTICAL DATA

Control Group

Subjects	Sex	C.A.	I.Q.	Pre. Ach. 15 items	Post Ach. 45 items	Delayed Ach. 45 items	Attitude to Arts	* Personality				Music P. - TM. - R.
								C	G	I		
P.A.	F	11-3	85	-	25	23	11	14	15	9	38	21
J.B.	M	10-5	92	-	23	26	8	12	17	12	27	11
D.D.	F	9-7	102	-	22	24	15	4	9	16	26	9
M.D.	F	9-6	99	8	28	30	12	12	17	12	24	11
P.H.	M	9-11	99	-	22	14	8	11	8	5	23	13
C.H.	F	9-3	127	-	44	43	14	12	14	7	44	26
C.L.	M	10	117	11	39	37	10	15	12	3	37	24
K.L.	F	10-5	95	11	27	30	9	12	12	10	17	7
R.L.	M	9-7	99	-	25	24	9	12	12	11	31	4
S.L.	M	10-7	84	5	34	29	6	14	7	7	15	7
M.M.	M	10-1	139	-	44	41	9	13	13	7	24	12
T.M.	F	9-11	103	13	39	39	18	12	17	13	22	13
D.M.	F	9-6	108	9	38	23	15	9	14	7	46	14
D.P.	M	9-11	110	7	38	42	5	10	11	5	28	6
J.R.	F	9-9	118	-	36	36	13	9	16	13	38	25
M.S.	F	9-2	128	6	42	43	12	13	15	10	30	26
R.S.	M	10-4	79	-	24	18	14	9	14	15	28	9
B.T.	F	9-8	90	-	24	12	13	9	11	14	10	2
W.T.	M	9-9	135	-	34	32	6	10	13	6	31	13
L.W.	F	9-6	130	11	41	37	10	14	12	10	39	25
B.W.	F	9-11	127	-	30	37	11	7	8	13	36	14
K.W.	F	9-11	128	7	43	43	18	11	10	15	31	18
L.W.	F	10-1	101	10	27	31	19	13	19	12	21	17

* Below average (-), Average (0), Above average (+) scores based upon maturity of students and other variables referred to in the I.P.A.T. Questionnaire Manual.

ACHIEVEMENT TEST RELIABILITY DATA

Subjects	1st Adm.	x	x^2	2nd Adm.	y	y^2	+	xy	-
1	28	1.300	1.690	29	.334	.111	.434		
2	34	7.300	53.290	31	2.334	5.447	17.038		2.197
3	30	3.300	10.890	28	-.666	.444			6.301
4	24	-2.700	7.290	31	2.334	5.447	.400		
5	27	.300	.090	30	1.334	1.779			
6	22	-4.700	22.090	26	-2.666	7.107	12.530		
7	31	4.300	18.490	32	3.334	11.115	14.336		
8	22	-4.700	22.090	25	-3.666	13.439	17.230		
9	30	3.300	10.890	29	.334	.111	1.102		
10	28	1.300	1.690	32	3.334	11.115	4.334		
11	34	7.300	53.290	29	.334	.111	2.438		
12	33	6.300	39.690	31	2.334	5.447	14.704		
13	32	5.300	28.090	30	1.334	1.779	7.070		
14	14	-12.700	161.290	20	-8.666	75.099	110.058		
15	32	5.300	28.090	31	2.334	5.447	12.370		
16	28	1.300	1.690	29	.334	.111	.434		
17	11	-15.700	246.490	23	-5.666	32.103	88.956		
18	31	4.300	18.490	35	6.334	40.119	27.236		
19	21	-5.700	32.490	17	-11.666	136.095	66.496		
20	25	-1.700	2.890	26	-2.666	7.107	4.532		
21	10	-16.700	278.980	22	-6.666	44.435	111.322		
22	35	8.300	68.890	32	3.334	11.115	27.572		
23	30	3.300	10.890	33	4.334	18.783	14.302		
24	38	11.300	127.690	37	8.334	69.455	94.174		
25	30	3.300	10.890	32	3.334	11.115	11.002		
26	21	-5.700	32.490	29	.334	.111		1.903	
27	25	-1.700	2.890	34	5.334	28.451		9.067	
28	27	.300	.090	27	-1.666	2.775		.499	
29	17	-9.700	94.090	19	-9.666	93.431	93.760		
30	31	4.300	18.490	31	2.334	5.447	10.036		
801			11406.300	860		644.651	763.966	19.967	

ATTITUDE TEST RELIABILITY DATA

Subjects	1st Adm.	x	x ²	2nd Adm	y	y ²	xy	+	-
1	4	-7.000	49.000	4	-7.033	49.463	49.231		
2	15	4.000	16.000	15	3.967	15.737	15.868		
3	15	4.000	16.000	17	5.967	35.605	23.868		
4	9	-2.000	4.000	10	-1.033	1.067	2.066		
5	12	11.000	121.000	12	.967	.935	10.637		.363
6	12	11.000	121.000	11	-.033	.001	15.165		
7	6	-5.000	25.000	8	-3.033	9.199	15.165		
8	12	11.000	121.000	5	-6.033	36.397	66.363		
9	10	-1.000	1.000	6	-5.033	25.331	5.033		
10	16	5.000	25.000	16	4.967	24.671	24.835		
11	17	6.000	36.000	20	8.967	80.407	53.802		.033
12	11	0.000	0.000	11	-.033	.001	17.802		
13	17	6.000	36.000	14	2.967	8.803	2.066		
14	9	-2.000	4.000	10	-1.033	1.067	56.264		
15	3	-8.000	64.000	4	-7.033	49.463	1.967		
16	11	0.000	0.000	13	1.967	3.869	13.934		
17	19	2.000	4.000	18	6.967	48.539	6.099		
18	7	-3.000	9.000	9	-2.033	4.133	19.888		
19	15	4.000	16.000	16	4.967	24.671	1.967		
20	11	0.000	0.000	13	1.967	3.869	48.198		
21	5	-6.000	36.000	3	-8.033	64.529	9.099		
22	8	-3.000	9.000	8	-3.033	9.199	25.165		
23	6	-5.000	25.000	6	-5.033	25.331	11.868		
24	15	4.000	16.000	14	2.967	8.803	2.066		
25	9	-2.000	4.000	10	-1.033	1.067	24.835		
26	16	5.000	25.000	16	4.967	24.671	49.231		
27	4	-7.000	49.000	4	-7.033	49.463	41.802		
28	17	6.000	36.000	18	6.967	48.539	6.099		
29	8	-3.000	9.000	9	-2.033	4.133			.033
30	11	0.000	0.000	11	-.033	.001			
		877.000		331	658.964		538.835	66.792	
		330							

February 16, 1970

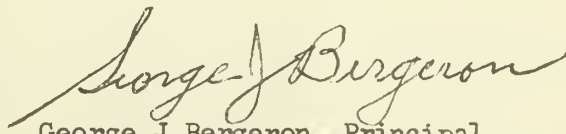
Dear Parents of Fourth Grade Pupils:

We are always searching for ways to improve our instructional program. It is important that we find ways to help the children learn more readily.

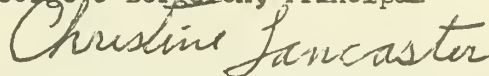
We are taking the opportunity to work with Professor D. W. Morris of Keene State College on a mathematics project. Professor Morris has been involved in an extensive study relating the arts with the enrichment of instruction in mathematics.

During this study we will have the opportunity to compare changes in student behavior in a specially designed learning situation with those in a traditional learning situation. The students will receive no less instruction than is normally given and will be carefully observed and tested during and after the study.

Professor Morris will teach both groups for about forty minutes for three days a week for three weeks. We expect that the results will be helpful in reviewing and enriching our instructional program.



George J. Bergeron, Principal



Miss Christine Lancaster, 4th grade teacher.



Mrs. Shirley Heise, 4th grade teacher.

March 11, 1970

Dear Parents:

The 4th grade students of Wheelock School are being offered the opportunity to attend two additional 30 minute sessions of instruction in Geometry on Saturday, March 14 and March 21.

Attendance at these sessions is voluntary and will in no way affect your child's standing in this class.

Group A will start at 9:00 A.M.

Group B will start at 10:00 A.M.

(Each student knows which group he or she is in.)

Please call the Wheelock School before Friday noon if your child wants to attend these sessions but has a transportation problem. We will make arrangements to accomodate the situation if possible.

Your cooperation in this matter will be appreciated.

Respectfully yours,

A handwritten signature in cursive script, appearing to read "D.W. Morris".

D.W. Morris, Project administrator.



April 30, 1971

Director of Publications
Addison - Wesley Publishing Co., Inc.
Reading, Massachusetts

Dear Sir:

I have designed a doctoral research project in which the arts are used to reinforce the learning of certain concepts in geometry. Some of the concepts, objectives and procedures used in the study are taken from sections dealing with geometry found in the Teachers Manual, Book 3 of the Elementary School Mathematics, second edition. (Philippines Copyright 1968.)

This letter is a request for permission to use the above-mentioned information in the Geometry Unit I (pp. 44-51) and Geometry Unit II (pp. 128-135).

It is understood that in the event the dissertation is published, credit will be given to your publishing company for the use of the material.

An early reply to this request will be most appreciated.

Respectfully,

Donald W. Morris
Professor of Music

DM/jb



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May 12, 1971

Donald W. Morris
Professor of Music
Keene State College
Keene, New Hampshire

Dear Professor Morris:

It is quite permissible for you to reprint pp. 45-51 and pp. 128-135, in the manner you described in your letter of April 30, from our Teachers' Edition, Book 3 of ELEMENTARY SCHOOL MATHEMATICS, second edition, by Robert E. Eicholz and Phares G. O'Daffer. Your dissertation must include, however, full credit to the original publication listing author, publisher, and copyright date.

Should you ever publish your work you must again apply for permission.

Sincerely,

(Mrs.) Jeanne Arnot
Assistant Permissions Editor

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